november 1958

nlgi spokesman

journal of the national lubricating grease institute

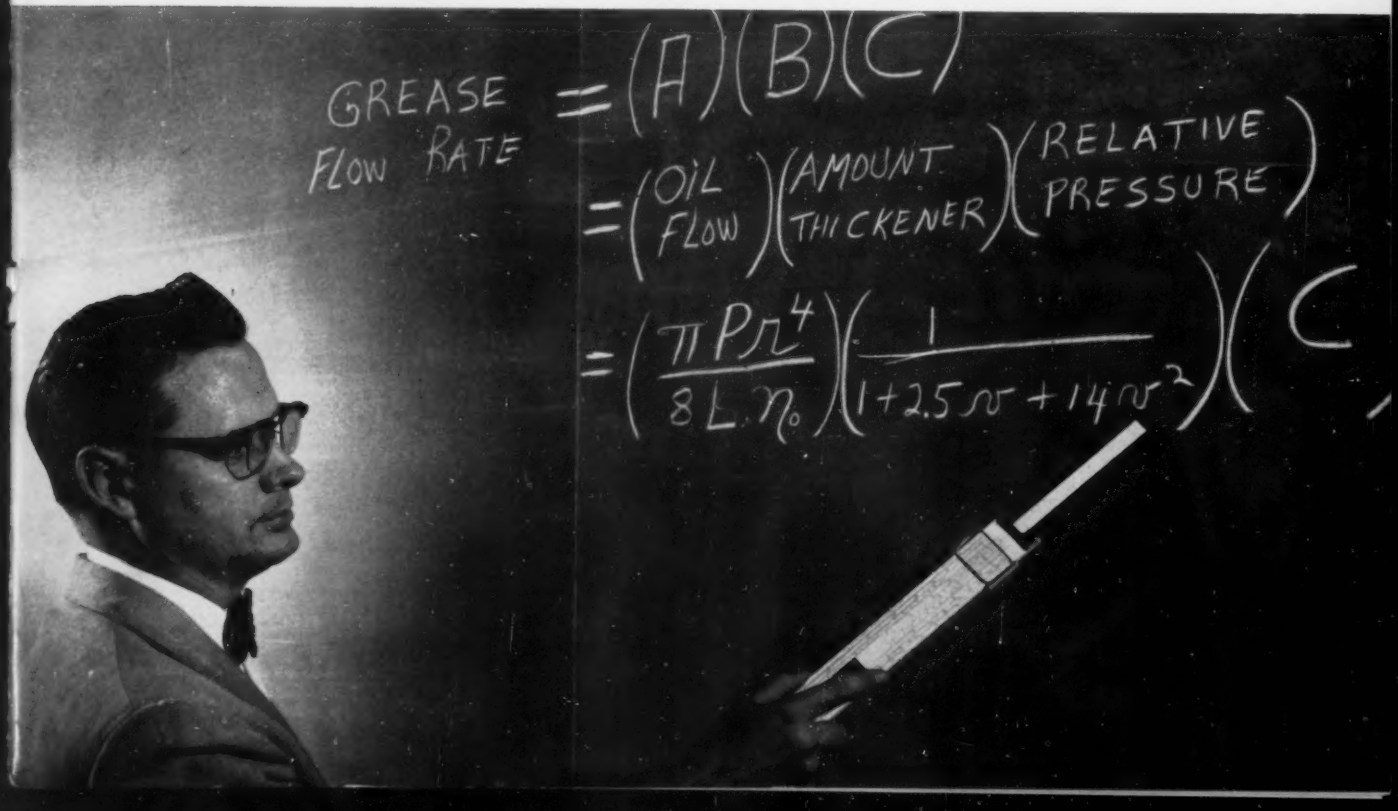
Social Maturity for the Corporation
By R. P. DINSMORE

Newly Elected NLGI Officers and Directors for 1958-59

NLGI 1957 Production Survey

Definitions of Terms Relating to the Lubricating Grease Industry—Part II
By W. J. EWBANK

A New Equation for Calculating Flow of Lubricating Greases
By D. W. CRIDDLE



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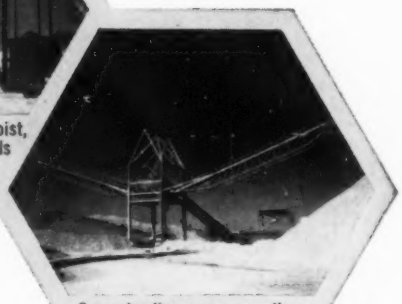
Conveyor-stacker handling moist, sticky material which builds up on the rollers.



Ore unloading conveyor rollers handling 200 tons of ore per hour.

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Pinion gear transmitting power from 600 h.p. motor to a ball mill.

Pan Conveyor handling hot clinker (1600°F), roller bearings in dusty, moist atmosphere.

V.A. Wemco classifier, part of wet grinding system, lower bearing submerged in hot sludge.

Leach tanks handling hot slurry, agitators driven by Falk gear reducing units.

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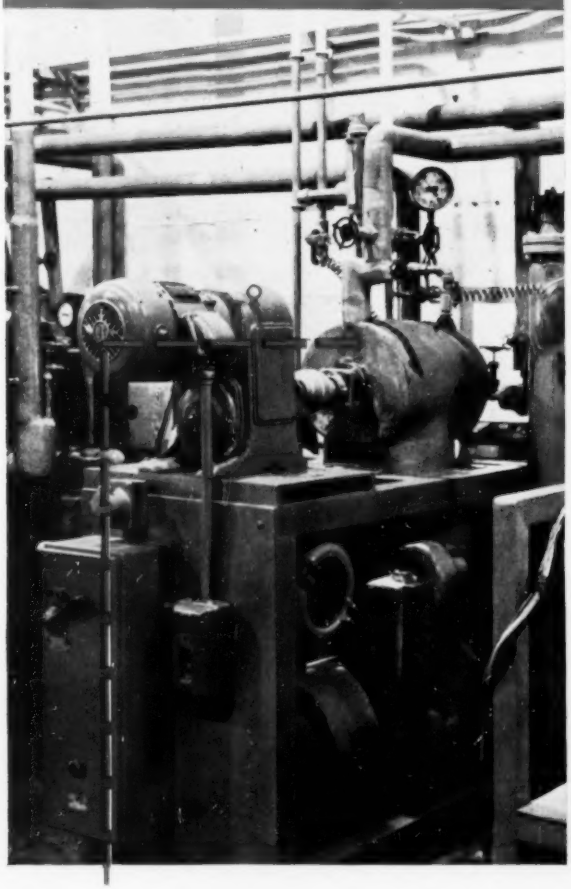
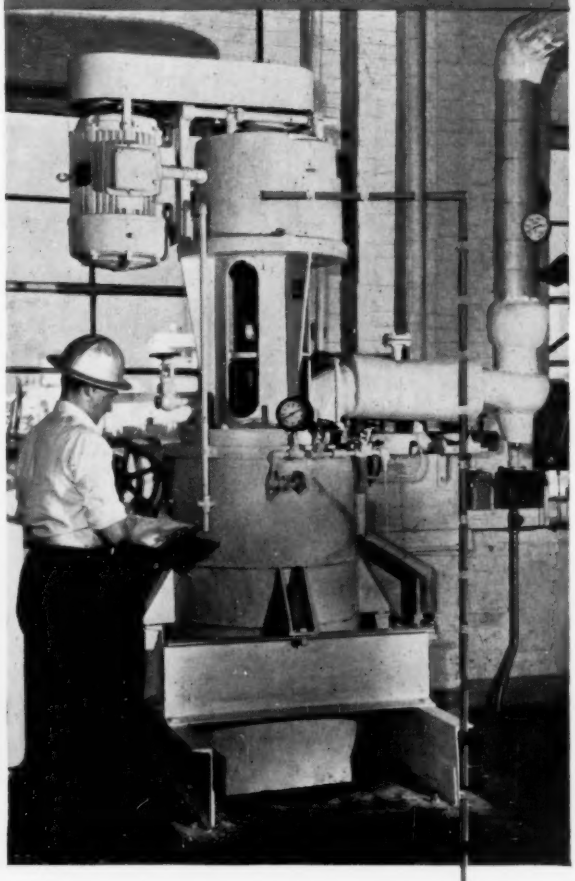


VOTATOR UNIT IN PRODUCTION. . drive end of a 24" x 120" (60 sq. ft.) unit at the Baltimore Refinery of Esso Standard Oil Company.



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Future Meetings

NOVEMBER, 1958

5-6 SAE, national fuels and lubricants meeting, the Mayo Hotel, Tulsa.

6-8 National Oil Jobbers Council, Conrad Hilton Hotel, Chicago.

10-12 API annual meeting, Conrad Hilton Hotel, Chicago.

30-Dec. 5 ASME, annual meeting, Statler and Sheraton-McAlpine hotels, New York City.

JANUARY, 1959

25-27 ASLE gear symposium, Hotel Morrison, Chicago.

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FEBRUARY, 1959

2-6 ASTM National Meeting, William Penn Hotel, Pittsburgh, Pa.

16-17 Packaging Institute, Petroleum Packaging Committee, Goodhue Hotel, Port Arthur, Texas.

26-27 API Division of Marketing, Lubrication Committee Meeting.

***MARCH, 1959**

3-5 SAE Passenger Car, Body, and Materials Meeting, Sheraton-Cadillac, Detroit, Mich.

APRIL, 1959

15-17 National Petroleum Association, Semiannual Meeting.

21-23 ASLE Annual Meeting and Exhibit, Hotel Statler, Buffalo, New York.

MAY, 1959

4-6 API Division of Marketing, Lubrication Committee Meeting.

15-24 International Petroleum Exposition

27-29 API Division of Marketing, Midyear Meeting.

31-June 6 Fifth World Petroleum Congress.

JUNE, 1959

14-19 SAE Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

OCTOBER, 1959

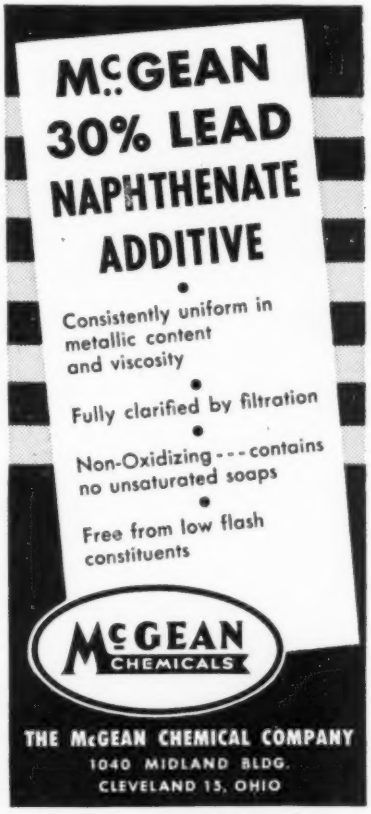
26-28 NLGI Annual Meeting, Roosevelt Hotel, New Orleans, La.

APRIL, 1960

19-21 ASLE Annual Meeting and Exhibit, Netherland-Hilton Hotel, Cincinnati, Ohio.

JUNE, 1960

26 ASTM National Meeting with Exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.



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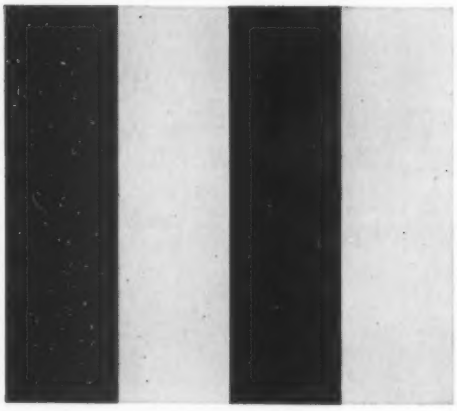


News About NLGI

NLGI Representatives Are Announced

The *Pure Oil* company has named Mr. N. D. Williams, general manager, sales service departments, as their NLGI company representative. Mr. Williams replaces Pure's director of research, Mr. H. L. Hemmingway, who is a former director and a past president of the Institute.

The *Gulf Oil* corporation has named Mr. E. W. Campbell, coordinator, direct sales, as their NLGI company representative. Mr. Campbell replaces Mr. D. P. Clark, assistant to the marketing vice president and a former member of the Institute's board of directors.

The *British American Oil* company has named Mr. S. C. M. Ambler as their NLGI company representative . . . Mr. Ambler is product line coordinator for this Toronto headquartered Canadian member.

Riley Brothers, Inc. has named Mr. H. P. Riley, president, as their NLGI company representative. Mr. Riley replaces his brother, the late Dan T. Riley, who recently passed away.

Standard Oil company (Indiana) has named Mr. L. C. Brunstrum, section leader in charge of research on greases and industrial lubricants, as NLGI technical representative. Mr. Brunstrum is current vice chairman of the Institute's technical committee. He replaces Mr. E. W. Adams, longtime chairman of NLGI's research fellowship subcommittee. Mr. Adams is administrative director of Standard's Whiting laboratories.

E. F. Houghton has named Mr. C. R. Schmitt, assistant to the vice president, sales, as NLGI company representative. Mr. Schmitt replaces Mr. Frank Ross, recently promoted to vice president—sales.

Shell Oil company has named Mr. T. F. Shaffer, manager, industrial products department, as their NLGI company representative. Mr. Shaffer replaced Mr. B. G. Symon, who is a former director and a past president of the Institute. Mr. Symon has been named a vice president of International Lubricants Co. in New Orleans.

Constitution Changes Are Approved

Amendments to the NLGI constitution and by-laws which were proposed to Active member firms in September were passed with a satisfactory majority, it was announced by the Institute's national office on October 20, 1958.

The second revision in NLGI's history provided that the board of directors could be enlarged from the present eighteen company representatives to as many as 24 men . . . that an officer designated as the secretary could be elected from the board . . . and that the Institute's managing executive would be known as the "general manager" rather than executive secretary.

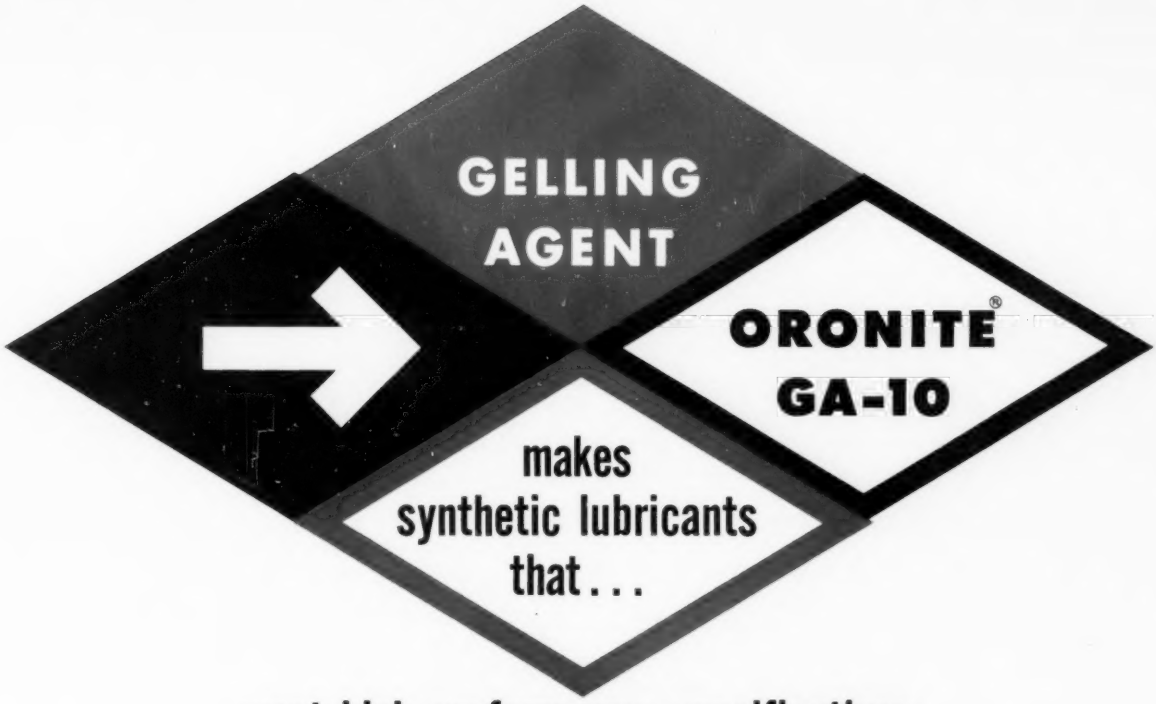
Passage of the measure made the changes effective as of October 20 and Active members then enlarged board representation from eighteen men to 21, leaving three positions to be filled at a later date. A secretary was also elected. The details on the amendments may be found elsewhere in the journal, on the President's Page.

SERVICE AIDS

Send Orders to: National Lubricating Grease Institute, 4638 Nichols Parkway, Kansas City, Mo.

NLGI MOVIE — "Grease, the Magic Film," a 16-mm sound movie in color running about 25 minutes, now released. First print $600, second print $400, third and subsequent orders $200 each (non members add $100 to each price bracket).

VOLUME XX — Bound volume of the NLGI SPOKESMAN from April, 1956 through March, 1957. An excellent reference source, sturdily bound in a handsome green cover . . . $7.00 (NLGI member price) and $10.00 (nonmember) plus postage.



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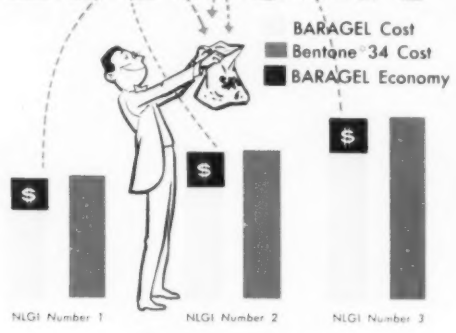

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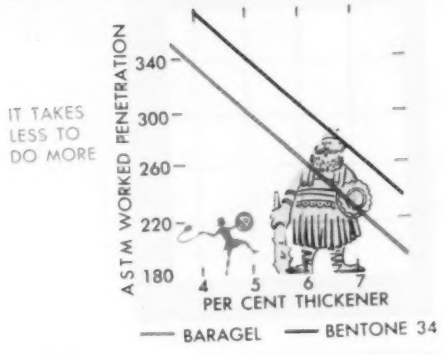

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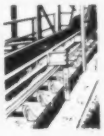

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THE COVER

FOR all greases examined, the flow rate was found to equal the equation shown on the front cover, where author Dean W. Criddle of the California Research corporation points out this key formula. Criddle, a former author for the journal, has offered a second paper. "A New Equation for Calculating Flow of Lubricating Greases," which is the final paper presented in the magazine taken from the 1957 NLGI Annual Meeting in Chicago. Beginning with the December, 1958 issue of the NLGI SPOKESMAN, material offered in Chicago last month will be offered to readers of the Institute's journal.

The NLGI SPOKESMAN is indexed by Industrial Arts Index and Chemical Abstracts. Microfilm copies are available through University Microfilm, Ann Arbor, Mich. The NLGI assumes no responsibility for the statements and opinions advanced by contributors to its publications. Views expressed in the editorials are those of the editors and do not necessarily represent the official position of the NLGI. Copyright 1958. National Lubricating Grease Institute.

NLGI PRESIDENT'S PAGE

By F. E. ROSENSTIEHL, *President*

Expansion for Future Progress

The National Lubricating Grease Institute has grown from only a handful of members when it was founded in 1933, to something over 150 today. This growth has been very gratifying and encouraging. It has allowed the Institute both to step up and to expand its activities in helping promote the better development and use of lubricating greases.

As the Institute has grown, however, and taken on new responsibilities, it has become apparent that certain revisions in the Constitution and By-Laws were also necessary. In particular, there has been a need to expand the allowable number of members on the Institute's Board of Directors. This has been done, with the maximum allowable membership of the Board increased by six.

This step will certainly be welcomed by the Institute as a whole. By providing a wider cross-section of the Institute's members, the new Board will be more sensitive to the needs and desires of the membership and accordingly more effective in carrying them out.

In order to meet statutory requirements, the Constitution has also been revised to provide that a member of the Board be elected each year to serve as the Institute's secretary.

Finally, a third revision involves a clearer definition of the duties and responsibilities of the Institute's paid managing executive. To avoid a confusion of this paid executive with the newly elected secretary, his current title of "Executive Secretary" was changed to "General Manager."

It is the firm belief of your Board that these revisions will serve to strengthen the Institute's overall organization and operation. As your new president, I sincerely hope that they will also encourage every NLGI member to play an increasingly active role in his Institute this coming year. Your Board, your NLGI SPOKESMAN, the meetings and many activities of the Institute are, after all, only as strong as the membership that can actively support and benefit from them.

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Emolein 2910 Lubricant Ester, formerly designated Emery 3033-S, is the answer to lower-cost synthetic fluids and greases required by the jet age. In synthetic fluids, total cost can be reduced substantially by blending Emolein 2910 with an azelate diester without sacrificing performance. In greases, Emolein 2910 can be used alone or by blending with other fluids.

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Social Maturity for the Corporation

By Dr. R. P. Dinsmore
Goodyear Tire and Rubber Co.

IT IS A PRIVILEGE to address this fine organization and especially you who represent it in person. It has been difficult to select from many possible subjects the one that might interest you most, but I believe that the one I have chosen is of such immediate importance it cannot fail to interest you, unless I fail to present it properly. I should also tell you that the opinions expressed in this talk are my personal views and are not necessarily those of my company.

It has been my good fortune, although my entire career has been spent in the rubber industry, to be in frequent association with engineers and scientists who represented a wide section of industry, teaching, and government services. The fundamental peculiar characteristic of industry is that it operates on private capital. By the use of this capital, industry or industrial management provides goods or services for sale at a profit which must pay for the use of the invested capital and provide for needed growth. Industry must, of course, operate within the laws and regulations of our local, state, and federal governments.

The lubricating grease industry and the rubber industry have the similarity of supplying components to other industries, of which those engaged in the manufacture of transportation vehicles and equipment are, by far, the most important. Incidentially, you devote your efforts to the reduction of friction in order to limit power loss and wear and we have similar objectives in the transmission of power by tires or belts. However, we are also interested in the opposite objective of maintaining a high level of friction for tire traction and also for brake-friction surfaces. However, even though these matters are of mutual interest and are essential services that we offer the public, it is not my intention to dwell upon them. I shall rather discuss with you matters of broader importance, but in which we all are, of necessity, involved.

Presented as the Keynote Address
at the 26th Annual Meeting of NLGI

Edgewater Beach Hotel
October 27, 1958

Corporations are considered as individuals in the eyes of the law and like individuals they have objectives, aptitudes, responsibilities and varying degrees of social maturity. They likewise have reputations dependent upon their honesty, integrity, business acuity, leadership, etc. If their economic influence is dependdent upon size, their sociological influence is dependent upon character and solidarity.

Nevertheless, because of their size, corporations exercise important influences in our social system. This is not alone because of the number of individuals who depend upon them for their daily occupations, or as stockholders for a steady return on their invested capital, but also because of their abilities to increase productivity through improved methods and equipment; to develop new and useful products or services; and to modify the working environment of numbers of workers.

These powerful social influences are subject to many legal restrictions—some of which are wise and just and others seem unfairly restrictive and discriminatory. Regardless of this, however, corporations, like individuals, have the need to go beyond their legal obligations, by supplying the leadership and community and social service which distinguishes the good citizen from the indifferent one.

There are multiplying signs that this obligation of good citizenship is being recognized by more and more of our large and successful corporations. If this were not so I should not be discussing this subject. Since it is so, I should like to examine with you the implications for our future planning. It may perhaps appear that this corporate attitude is not unduly idealistic or impractical, but, on the contrary, a wise adaptation to the conditions and temper of the times which is an essential feature to progressive civilization.

I fear that this sounds vague and general, but I shall turn at once to specific details. For these let us look at problems which are of serious importance to industry. They are not necessarily presented in the order of their importance which may differ somewhat from time to time and from industry to industry. They all have significant sociological reactions.

The ups and downs of the business cycle are the cause of one of industry's oldest and most serious problems. The timing and depth of these swings are never closely predictable. They cause loss of profits, loss of employee earnings, and require disturbing psychological adjustments.

The demands of organized labor are becoming more onerous as these groups gain in wealth and experienced leadership. Since their demands are not related to productive output or the earnings of the company, they create a growing burden on industry and create a potent force for increasing inflation.

High corporate income taxes make it difficult to retain sufficient income to provide for plant expansion and plant replacement. This difficulty is enhanced by the steadily increasing cost of plant and equipment—another feature of inflation. It is obvious that every company—large or small—must provide some expansion, otherwise population and community growth overtake it and it becomes a decreasing factor in its field.

We are in a very dynamic industrial society. Methods of transportation and communication change rapidly and tend to become more complete; that is, they are available to more people more frequently. It is axiomatic that in such an environment, the wants of the individual change and there is a shift in their emphasis. Novelty in itself becomes a desirable attribute. Moreover, the public associates the ability to improve with the ability to make quality goods. All of these things point up the necessity for a constant flow of improved and new products for the growing concern. In this connection also, finding capital from retained earnings is so difficult that even very large corporations must, from time to time, resort to borrowing.

Improvements in transportation and communication provide only a part of the results of profound contributions made by the basic physical sciences and the allied technology. We are all familiar with the words so glibly used in the public print such as radar, electronics, transistors, automation, statistical planning of experiments, radioactive isotopes, antibiotics, and literally scores of others. These in themselves are not significant but the fact that they have appeared only in the last few years is an extremely important consideration.

Entire industries have been created for the manufacture of tools and equipment literally unknown twenty years ago.

Further investigation of the exciting leads furnished by discoveries which have already been made, the technological application of our new knowledge with ramifications that are almost beyond our imagination, and the need to teach young people to carry on these activities in the future, have brought about over night a large and steadily-growing demand for trained scientists and engineers. In the public mind, this need is chiefly associated with the necessity to offset similar activities by the Russians, but actually were no such threat existent our peacetime requirements would be very heavy indeed.

The technological revolution that is going on is not fully understood by many industrial managements. It is moving now and will move with increasing speed to revolutionize production equipment and processes, the scheduling of production, transportation of goods and sales inventories, and the interchange of information between all parts of the sales field and the produc-

tion centers. The competitive implications of this movement are as portentious as any that have appeared on the industrial horizon in the last century. One of the considerations involved is the increasing number of technical and semi-technical people, not merely for the development of new processes and products but for servicing the controls which in the future will be essential to permit the smooth and continuous operation of the complex industrial machine.

This brings us to one of the most serious problems of the modern industrial manager. It is the more serious because it is difficult to understand and to trace back to its origin. It has to do with the increasing ratio of nonproductive people to productive workers. It is so large a subject that it would be impossible to amplify it here but one fact is worth noting. In a transition period such as this there are always inequalities in the activity and speed of movement, not only between various segments of industry but also within any particular large business organization. That is to say, the competitive need to accomplish a certain result more quickly is recognized but the method of doing it economically is not always known or if known may not be available. It is as though at the time the typewriter was beginning to become an important piece of industrial office equipment, a large business firm found itself obliged to triple its correspondence without being able to get the necessary typewriters or trained typists to operate them. For the time being and until the transition could be effected he would have to triple his staff of clerks whose business it might be to pen the letters.

Reasons of this nature are among the important causes of mounting overhead expense. It must also be realized that these same causes are affecting the productivity of research and development which has multiplying demands upon it but has not yet learned how to utilize all of the labor-saving devices which are available or are becoming available.

If we leave for the moment this confusing problem of mounting overhead, we are confronted with another which is involved in the foreign competition. We have depleted our natural resources in many cases to the point where we must purchase some of these materials from other countries, particularly at times of peak demands. The supply of foreign materials naturally tends to persist even when not required by shortages, and these tend to be supplemented by the introduction of manufacturing goods from other countries as well. Generally speaking, their labor costs are much lower than ours and countries with a high degree of mechanical skill, such as Japan, Germany and Switzerland, are able in many cases to undersell the products of our own factories. The classical method of dealing with this problem is to use restrictive tariffs, but these tend to interfere with essential international trade required for exchange stability.

The foregoing problems are certainly not all of the things that are perplexing industrial management, and I have no doubt that the heads of many companies would cite some that I have not mentioned as being just as serious; however, they serve to exemplify the type of problem that I am talking about which not only has grave implications for industry itself but the method and speed of the solutions are important to our entire social system.

I would like to dwell briefly on some of the remedies that have been applied, or can be applied. If I am not too specific about who is doing these things or where, I am citing them like the rooster who showed the hen the ostrich egg not by way of criticism but to illustrate what is being done in other circles.

It is possible but not probable that we can make any important change in the nature of the business cycle without a modification of our national psychology. The best hope we have is to put ourselves in a position to adapt quickly to changes in the business situation and thus minimize the effects on all concerned.

Obviously, this can best be done by the rapid flow of accurate information. Each business could and should set up means for keeping its fingers on the pulse in the sales field; changes in degree and kind of demand; changes in the character and quantity of the stocks of its distributors; and the best information available regarding trends not only within the industry but generally. Some of the information can hardly be obtained except by government agencies which at present do a very incomplete job of supplying information quickly. Social security would be much nearer to a reality if more money were spent on the rapid acquisition and distribution of statistics.

It appears to me that generally the industrial management's approach to labor problems has been similar to our governmental approach to the problem of the aggressive absorption of small countries by the Soviet bloc of nations. I mean by that, it is one of containment in an effort to prevent the spread of the movement or at least to slow it down. Just as we do not like to contemplate the injury of the innocent citizens of the countries involved, so business management does not like to contemplate damage to the financial position and morale of the people who build its products. The result is not even as good as a stalemate because opposition leadership in both cases deterred by no similar scruples, makes steady progress in the attainment of its selfish ends.

Some people believe that this will ultimately result in government regulation of wages and prices. This would be a remedy brought about by failure and despair. Many people believe that if the problem were to be approached from a positive viewpoint, a formula could be evolved that would give to labor its fair share of return and would in fact ensure an increasing

return if and as the cost of producing goods decreases. There is no doubt that the cooperation of labor is going to be essential to the satisfactory adaptation of revolutionary methods to the production of goods. There is likewise no doubt that it is just as important to organized labor to find a satisfactory formula as it is to industrial management. These methods will come despite any action or lack of action on the part of either. If it does not come within industry as now established, it will spring up in new industries, and if it does not come within the country, it will come in other countries. To solve this problem is in my opinion one of the foremost tests of modern management, and it probably will have to be done by representative groups of management and labor working together.

Modification of the corporate income tax is naturally the function of Congress. Demands for money for government expenditure are so great that it is doubtful whether Congress will make any modification in the tax structure unless there is a popular demand for it based upon sound reasons for belief that it would react to the national benefit.

It would appear that the National Association of Manufacturers and some privately financed organizations have made sound recommendations for tax reform not only in the area of corporate taxation but with respect to individuals as well. However, constantly recurring defense emergencies tend to neutralize these projects.

It seems to me that there are two further things that business management might do: one is to inform their employees in easily understandable terms of the benefit to them and to the general public of intelligent tax reform. The other is to insist upon a more effective organization of our Department of Defense which certainly has far too little to show for the funds which have been taken from the overburdened taxpayer and poured into its coffers.

The problems which have been discussed involving the need for the continuous flow of new products, the shortage and potential shortage of scientists and engineers, the revolution in industrial methods which in its transition period tends to increase costs, particularly in overhead, all involve the requirement for the same kind of management approach to their solution. It is important first that the attitude be correct. There should be no assumption that because these modern methods are intricate and difficult to understand they belong in the ivory tower and have no place in a modern industrial institution. Nor should it be supposed that if a group of experts is planted quietly in one corner, they will eventually come up with all the solutions of the organization's problems. It is the function of the manager of a modern business not to know how every detail works but what it will accomplish and what kind of people are needed to make it operate. Those who decide to sit by and wait until the success of modern methods has been demonstrated by others will find themselves caught in an increasing competitive squeeze for which they are not prepared and for which they can find no simple and rapid remedy. It is my belief that just as we as a nation were caught napping by failing to appreciate the significance of the long-range missile, so we in industry are in danger of underestimating the significance of modern high speed methods as revolutionary factors in the operation and mangement of industrial companies.

The problem of foreign competition is a natural result of the cost situation built up by the demands of organized labor and failure to utilize quickly the modern methods which are daily coming to our hands. If we find a solution to these problems we shall not be much troubled by lower cost production in other countries. If we do not, the competitive pressure from many of these countries will exceed anything that we have hitherto experienced.

In closing, if I may speak again of the corporation as an individual, he finds himself in the difficult position of being obliged to carry out his function as a citizen under the pressure of greater technological and sociological changes than have ever faced him or his predecessors in industrial history. If he measures up to public needs and expectations he will not only have gone far to preserve our free, competitive industry but he will have dealt a blow to socialism, communism, and totalitarianism that will probably be far more effective than any that our Armed Forces can devise. To do this he should not hesitate to impart the significance of his plans to employees, legislators, and the general public. This in my view is the meaning of social maturity. ■

About the Author

R. P. Dinsmore *received his BS degree in chemical engineering from the Massachusetts Institute of Technology in* 1914 *and an honorary English degree from Case Institute of Technology in* 1940. *From* 1914 *to* 1916 *he was with the technical staff of Goodyear Tire & Rubber company in Ohio. He held many positions in the company and rose to vice president, a position he has held since* 1943. *He is also vice president and director of the Goodyear Synthetic Rubber Corp. and vice president and director of the Goodyear Atomic Corp. He is a member of ACS, SAE, Fellow AIC (President* 1955-56) *AICE (Director* 1953-56), *Fellow Royal Soc. Arts (Brit.),* 1949, *Fellow AAAS, Trustee, Midwest Research Institute since* 1946, *and he was awarded the Colwyn Medal by Institute of the Rubber Industry, London,* 1948, *Honorary membership AIC.*

NLGI 1958-59

Officers and Board of Directors

President

F. E. ROSENSTIEHL
The Texas Company

Vice President

H. A. MAYOR, JR.
Southwest Grease and Oil Co.

Secretary

J. V. STARR
Esso Standard Oil Co.

Treasurer

A. J. DANIEL
Battenfeld Grease and Oil Corp., Inc.

Rosenstiehl, Mayor, Starr and Daniel are well known names in the National Lubricating Grease Institute. . . these men are the elected officers of NGLI for the year 1958-59, holding the positions of president, vice-president, secretary and treasurer, respectively.

F. E. Rosenstiehl, sales manager, lubrications sales division, the Texas company, was elected 26th president of NLGI at the annual business meeting in the Edgewater Beach hotel, Chicago, on Monday, October 27.

A director of the Institute since 1950, Fred has served on some ten committees in that time, acting as chairman of membership, publicity, and last year as vice-president and chairman of the 1958 program committee.

Vice-president H. A. Mayor, Jr., executive vice-president, Southwest Grease and Oil, has been a board member since 1953, chairmanned membership, SPOKESMAN, awards, chassis lubrication and publicity committees. He will head the group planning next year's annual meeting. Dr. J. V. Starr, assistant to the manager, petroleum specialities department, Esso Standard Oil, is assuming the duties of secretary, a position created by amendment to the constitution and by-laws last month. John has been chairman of the awards, board composition and survey production committees, and has served NLGI since 1954.

For his seventh consecutive term, A. J. Daniel, president of Battenfeld Grease and Oil (Kansas City), was elected treasurer. A board member since 1945, he is a past president (1949-50) of the Institute and has served or chairmanned almost every operating committee of NLGI.

Eleven company representatives, including Mayor, were elected to the board of directors . . . seven men for three year terms, while four directors will serve terms created by vacancies. The directors and their firms represented on the board for three years:

E. W. Campbell, Gulf Oil corporation
R. Cubicciotti, L. Sonneborn Sons
A. G. Griswold, Cities Service Oil company
F. R. Hart, Standard Oil (California)
C. L. Johnson, Jesco Lubricants company
W. A. Magie, II, Magie Brothers Oil
H. A. Mayor, Jr., Southwest Grease and Oil

Directors and their firms represented on the board to fill two year terms:

S. C. M. Ambler, British American Oil company
A. S. Randak, Sinclair Refining
T. F. Shaffer, Shell Oil company

Elected to fill a one year term on the board:

T. W. Binford, D-A Lubricant company

The Institute's 1958 nominating committee proposed a larger slate than in years past, after Active members voted affirmatively on a resolution to enlarge board representation in September . . . the first change since NGLI was founded in 1933. The Institute's governing body meets five times a year and the men are usually active on several committees.

Directors...*

S. C. M. AMBLER
British American Oil Co.

T. W. BINFORD
D-A Lubricant Co.

E. W. CAMPBELL
Gulf Oil Corporation

R. CUBICCIOTTI
L. Sonneborn Sons, Inc.

A. G. GRISWOLD
Cities Service Research & Development Co.

F. R. HART
Standard Oil Co. (California)

C. L. JOHNSON
Jesco Lubricants Co.

W. A. MAGIE II
Magie Brothers Oil Co.

A. S. RANDAK
Sinclair Refining Co.

**Not shown . . . Mr. T. F. Shaffer, Shell Oil Company*

Two Past Presidents of NLGI Retire from Board of Directors

Two past presidents of NLGI took leave of positions on the board of directors after long and valuable service to the Institute. New assignments and the resulting change in responsibilities brought resignations from B. G. Symon and H. L. Hemmingway last month.

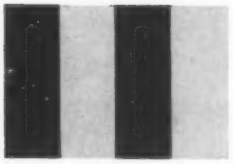
Symon, company representative for Shell Oil company and a director since 1945, was president of the Institute during 1948-49. Hemmingway, the Pure Oil company representative and a director since 1944, was president of NLGI during 1954-55. Both men devoted a wealth of time and talent to affairs of the Institute in the years they served.

Hemmingway was recently promoted to the position of director of research for Pure, while Symon, formerly manager, industrial products department, for Shell, is assuming a new position with International Lubricants company of New Orleans.

Two other directors who served the Institute since 1955 also tendered resignations because of a change in responsibilities. Mr. D. P. Clark, assistant to the vice president, sales, for Gulf Oil corporation, and Mr. H. P. Ferguson, manager, wholesale and subsidiary sales, for Standard Oil (Ohio) served on various NLGI committees with distinction.

H. L. HEMMINGWAY

B. G. SYMON



High Percentage of Returns in New Service–Fluid Gear Lubricants and Lubricating Greases Statistics

An Interpretation of NLGI's 1957 Production Survey

NEXT YEAR'S SURVEY

EDITOR'S NOTE—*The interpretation of NLGI's first production survey was a joint action by the Board of Directors, and edited by Dr. J. V. Starr, who not only served as chairman of the committee that studied the possibilities of such a service, but headed the committee supervising the survey once it had been accepted by the Active membership of the Institute.*

The second annual survey will be produced again, for 1958 production, with the schedule much the same as last year. Active members in Canada will be invited to participate on a separate Canadian survey, representing an enlargement of the data from 1957. This subject will be dealt with in detail in further issues of the journal.

An industry can wither and die if its members do not carry on intensive and continuous research. Certainly manufacturers of lubricating greases and fluid gear oils engage in continuous laboratory and field testing but often individual firms cannot gather specific data on industry-wide problems. Since there are certain kinds of data which can be supplied properly for the benefit of industry as a whole and as a service to its individual members, the feeling grew among Company Representatives of the National Lubricating Grease Institute that a survey of production—of the pounds produced in a calendar year would be a valuable contribution to industry research.

After careful consideration the Board of Directors felt that there was sufficient interest to conduct a survey of lubricating greases and fluid gear lubricants based on production for the year 1957. A committee was appointed to finalize a procedure which would be satisfactory to all. Several agencies were considered to make this survey, including various government agencies, the API, trade publications, etc. It was finally decided that this function should be carried out by the Services division of the certified public accounting firm of Ernst & Ernst.

Several points were agreed upon:

1. The survey should be based on production rather than on sales because in the case of the latter data there is frequent opportunity for duplication.
2. It was stressed that in reporting the figures members should be guided by the following ASTM definition for lubricating grease:

"Lubricating grease—a solid to semifiuid product of dispersion of a thickening agent in a liquid lubricant. Other ingredients imparting special properties may be included." The definition therefore excludes compounded and blended oils, process oils, soluble oils, etc. which often are produced in a "grease" plant.

3. It was agreed that production should be reported by the type of thickener, including aluminum soap, calcium soap, lithium soap, sodium soap, "other soap," and nonsoap (inorganic thickener). Greases containing two or more thickeners were listed under the category whose characteristics predominated.

4. The finalized plans assured that the statistics would be in the nature of a summary, and the data from each reporting member were to be submerged in the totals. A careful effort was made to preserve anonymity and since Ernst & Ernst had been selected to conduct this survey on the basis of similar work for other technical organizations, all mailings came from and were directed to this outside agency.

With National Lubricating Grease Institute's extensive representation among lubricating manufacturers in the United States (unofficially estimated at 95 per cent of all domestic production) it was felt that this industry-wide data would also have many advantages for other member classifications of the Institute. Suppliers of manufacturing and dispensing equipment, containers, ingredients, and marketing organizations could all utilize this information.

A total of 63 Active members received questionnaires by registered mail early in 1958. Replies received by the end of March totaled 48, or 76.2 per cent of the membership originally polled. This was considered to be an excellent return in view of the fact that a survey of this type was just being introduced. Three classifications were made of the results by the gathering agency as follows: Producing less than one million pounds, between one million and five million pounds, and over five million pounds. Each classification was applied to both lubricating grease and the fluid gear categories.

Manufacturers reporting production of less than one million pounds numbered eleven, while in the one to five million area fourteen firms replied. Twenty-three members reported production of over five million pounds. Based on known facilities, the reporting companies would seem to be in the main the primary producers. An informal estimate placed the total at approximately 85 per cent of the total domestic production. The grand total of fluid gear lubricants produced in 1957 was not subject to breakdown.

Production figures for only one year are not too meaningful. However, the Directors feel that this survey has been of value to many members and plan to continue this service regularly in the future. Thus, in a matter of a few years certain trends in production will become evident and the survey should have increasing value. While this year's survey is not complete, there has been no challenge of the totals since the data were released in April and the Institute believes the figures are reasonably accurate. It is hoped that with succeeding years participation in the survey, already high, will grow.

SUMMARY OF TOTAL POUNDS PRODUCED

A. Lubricating Greases	Pounds Produced	Per Cent
1. Aluminum Soap	27,142,543	4.66
2. Calcium Soap	218,844,369	37.61
3. Lithium Soap	160,462,383	27.58
4. Sodium Soap	128,859,083	22.15
5. Other Soap	28,680,446	4.93
6. Non-Soap (Inorganic Thickener)	17,891,004	3.07
Grand Total of Lubricating Greases	581,879,828	100.00
B. Total Pounds of Fluid Gear Lubricants Produced	473,999,270	

ANALYSIS OF REPLIES

Total active members mailed questionnaires	63
Total replies received	48*
per cent return	76.19%

CLASSIFICATION OF RETURNS ACCORDING TO SIZE

A. Lubricating Greases	
Number of replies reporting production of:	
Less than 1,000,000 pounds	11
1,000,000 to 5,000,000 pounds	14
5,000,000 pounds and over	23
	48
B. FLUID GEAR LUBRICANTS	
Number of replies reporting production of:	
Less than 1,000,000 pounds	19
1,000,000 to 5,000,000 pounds	11
5,000,000 pounds and over	18
	48

*Only one reply reported no production data.

WHAT'S IN A NAME

definitions of terms relating to the lubricating grease industry

Part II

By W. J. Ewbank, Cato Oil and Grease Company

GERTRUDE STEIN once said "A rose is a rose is a rose," a statement which is in the form of a definition, but which is so non-informative as be highly infuriating to most technically minded people. However, when we turn to the dictionary to find out what a rose really is, we find that Gertrude's definition is not too far out of place, since a rose can be many things and the true meaning is in the mind of the speaker.

To a botanist, a rose is "any of the wild or cultivated prickly-stemmed, showy-flowered shrubs constituting the genus Rosa, having in the wild state a corolla of five roundish petals."

To the amateur gardner, a rose is "any of the various related or similar plants" to the above, and usually means the plant itself rather than the flower.

To the bashful visitor, the rose is always the flower, and he would agree to the definition "the flower of any such shrub, of a red, pink, white or yellow color, and often fragrant," probably adding the postscript that they were also expensive. Incidentally a recent article on commercial rose growing included the fact that now roses are also green and lavender.

The commercial florist would probably accept all the definitions above; in his private thoughts a working definition would be that they were his most val-

uable merchandise, and also the contrary stuff which reaches full bloom the day *after* Mother's Day.

Similarly, to an artist rose is a color, to an architect a type of window, to a historian the symbol of opponents in an English civil war, and to a mariner a part of a compass.

This far from exhausts the possibilities. Three miles east of my home in Norman, Oklahoma, a peculiar geological formation displays thousands of stone "roses."

Thus, it can be seen that the way of the definer is not only hard, but strewn with pitfalls. In the scientific field also, three problems arise. I remember once hearing a physicist "explain" why you can see through a pane of glass by saying it possessed the property of transparency, which, of course is merely translating Miss Stein's approach into Greek.

Perhaps the preceding paragraphs can give some idea of the problems faced by your NLGI Committee on Definitions. While some words, especially those of limited and narrow use, do not present too many difficulties, those terms in general usage in the lubricating grease industry are also the terms found to have several somewhat varying meanings. Where separate and distinct means are found, two distinct definitions can usually be written. A case in point is "channeling" which has one meaning in connection with anti-friction greases, and another quite different meaning with gear lubricants. In this case, both definitions have been adopted and are shown in the list below.

In certain other cases, only a single definition can be made, but usages vary enough that the choice can be quite difficult. In fact, we have had the experience of circulating a definition, changing it in response to well though out and constructive criticism, and then getting an equal volume of comment asking us to change back to the original definition.

With these words, your committee attempts to listen to all variations in opinion, but finally must make some decision as to what we feel the majority of the lubricating grease industry want.

One such word was "additive," which also appears in the list below. In this case, there were two distinct schools of thought. One of them believed that the word should be generic for all types of materials added to lubricants for special purposes, while the other desired to restrict it to the detergent and EP materials, with for example, steam cylinder compounding not considered as an additive. Clearly, some decision had to be made, and in this case the first idea prevailed, with compounding being considered as a type of additive treatment.

One of our most difficult words to date has been "texture." Out of many possible definitions for this term, the committee adopted it as meaning the qualitative feel of the grease, using the thumb and forefinger test. Certainly, this is important commercially—probably this is the test most often run on greases, qualitatative though it be.

Although this aproach was approved by the Technical Committee at the last Annual Meeting, some objections were raised by marketing groups when the terms were submitted to the Board of Directors for final approval. The gist of these objections was that the test is not scientific or quantitative, and that sufficient terms were available for describing the characteristics.

It was therefore decided to withdraw this term from the list to be published this year, and reconsider the definition. By the time this is published, additional comment should have been received from Technical Committee members to guide us in our thinking. If any readers are desirous of participating in this work, they can obtain copies of the proposed definition of this and other terms under consideration by writing directly to the committee chairman.

In conclusion, I would like to present the list of terms finally approved as a result of the past year's work, and to thank the following members of the Committee on Tests and Definitions for their wholehearted co-operation in this important work during the past year:

A. S. Orr, Gulf Oil Corp., Vice-Chairman

C. J. Boner, Battenfeld Grease and Oil Corp.

M. L. Carter, Southwest Grease and Oil Co., Inc.

T. E. DeVilliers, Cities Service Oil Co.

J. J. Dickason, Jesco Lubricants Co.

H. U. Fisher, California-Texas Oil Co.

E. M. Higgins, Master Lubricants Co.

C. E. Hulme, Kendall Refining Co.

H. C. Zweifel, Richfield Oil Co.

DEFINITIONS

ADDITIVE—any material added to a lubricating grease or lubricating oil to improve its suitability for service. It may improve a property already possessed by the lubricant or give it properties not naturally possessed. (Additives are the "other ingredients imparting special properties" referred to in the definition of lubricating grease. Typical examples are anti-oxidants and "EP" or anti-weld additives.)

AGE HARDENING—increase in consistency (hardening) of a lubricating grease with storage time.

CAVITATION—in a lubricating grease dispensing system, failure for any reason of the material to flow to the suction of the system pump. (See also FEEDABILITY.)

CHANNELING—1. a term used in connection with lubricating greases to describe the (usually desirable) tendency to form a channel by working down of lubricating grease in a bearing, leaving shoulders of unworked grease which serve as seal and reservoir.

2. a term used in connection with liquid lubricants and flow type lubricating greases to describe the tendency at low temperatures, for these materials to form a plastic structure sufficiently strong to resist flow under gravitational forces only. (Similar to, but not identical with the pour point of liquid lubricants, it is measured by empirical tests such as Federal Method 3456-T.)

COLD SETTS—see SETT GREASE.

COMPLEX SOAP—a soap wherein the soap crystal or fiber is formed by co-crystallization of two compounds:

1. the normal soap (such as metallic stearate or oleate).

2. the complexing agent. (Examples of complexing agents are the metallic salts of short chain organic acids such as acetic or lactic, or the inorganic salts such as the carbonate or chlorides. Still another complexing agent is water, in which case the soap may also be referred to as a HYDRATED SOAP.)

FIBER—in lubricating grease, the form in which soap thickeners occur, the soaps crystallizing in threads which are of the order of 20 or more times as long as they are thick. (Most soap fibers are microscopic in size, so that the grease appears smooth to the eye. The greases having FIBROUS appearance are those where the fiber bundles are large enough to be seen by the naked eye. The most common fibrous lubricating grease is sodium base, although not all sodium base greases are fibrous.) See also APPEARANCE AND TEXTURE.

FIBRIL—an extremely small fiber, usually barely visible even at maximum magnification of the electron microscope. Fibrils may collect in bundles to form the larger fibers.

HOMOGENIZATION—the process of subjecting a lubricating grease to intimate mixing and intensive shearing action, the end result of which is to obtain a more uniform and higher degree of dispersion.

LUBRICATING GREASE STRUCTURE—the physical arrangement of the component particles of a lubricating grease thickener, additive and liquid lubricant. It is the nature and stability of this arrangement which determine the appearance, texture and physical properties of lubricating grease.

SETT GREASE—a lubricating grease made by mixing a mineral oil slurry of an alkali and a mineral oil solution of a fatty acid, saponification usually being completed after the mixture is poured into the shipping container. As the temperature of the mixture is generally less than 140 F, these products are sometimes known as COLD SETTS. Axle grease is usually a SETT GREASE.

SHEARING—slipping or sliding of one part of a substance relative to an adjacent part. In a solid, such action involves cutting or breaking of the crystal structure, but in a fluid or plastic, shearing does not necessarily destroy the continuous nature of the substance.

SHEAR RATE—the rate of slip within a substance engaging in flow. The *average* or *mean* shear rate in a pipe or tube is the average velocity divided by the radius of the tube. It, therefore, has the dimensions of the reciprocal of time and is usually expressed in the unit of reciprocal seconds (sec^{-1}). The mean shear rate is reported in the determination of apparent viscosity in ASTM method D 1092-55.

SHEAR STRESS—the force required to cause shearing in a substance. In fluids, the relation of the shear stress to the shear rate is the viscosity of the substance.

SOLID LUBRICANT—any class of lubricants wherein the reduction of friction and wear during sliding is caused by making the shearing take place within the crystal structure of a material with low shear strength in one particular plane. Examples include graphite, molybdenum disulfide and certain soaps. Lubricating grease is *not* a solid lubricant, but may contain solid lubricants as additives.

THICKENING AGENT—the solid particles which are relatively uniformly dispersed to form the structure of lubricating grease in which the liquid is held by surface tension and other physical forces (The solid particles may be fibers, as is the case with various metallic soaps, or plates of spheres, as is the case with some of the non-soap thickeners. The only general requirements are that the particles should be extremely small and that they be capable of uniform dispersion in the liquid lubricants.) ■

About the Author

W. J. Ewbank *is chairman of the committee on manual of test methods and definitions of terms in the lubricating grease industry, a project of the NLGI Technical Committee. He is director of research for Cato Oil and Grease company. Mr. Ewbank is also a previous contributor to the NLGI* Spokesman *magazine.*

A New Equation for Calculating Flow of Lubricating Greases

Presented at the NLGI 25th annual meeting in Chicago, October, 1957

By: Dean W. Criddle
California Research Corp.

VISCOSITY is an important property in the performance and characterization of greases. The "apparent viscosity," which is the ratio of shear stress to average shear rate, varies with shear rate and with working; [1,2] hence, it is difficult to express the flow properties in simple terms. Several different equations [3,4,5] are known for expressing flow as a function of stress; each of these equations has its utility and its limitations. A new equation is presented here that is both simple and useful. In this paper we explain the equation and how it is applied, show the usefulness of the equation to correlate and predict grease flow, and compare the advantages and limitations of this equation with alternate methods from the literature.

New Flow Equation and Its Justification

The conventional concept of plug flow is used here in a slightly modified form as follows. Greases deform by a creep process at pressures below the "yield point." At pressures above the yield point, gross shear of the grease occurs. When greases flow at low shear rates in a tube, gross shear occurs only near the wall of the tube, [6] and the apparent viscosity is extremely high; but a central "plug" flows as a unit with small deformations due to creep. At high shear rates the central plug decreases in diameter and the apparent viscosity of the grease approaches that of the oil. At intermediate shear rates the apparent viscosity of the grease is between the oil viscosity and the creep viscosity.

Flow of greases is considered to be determined by three factors: A, the flow rate expected for the oil; B, a term which corrects for the volume fraction thickener; and C, a term determined by the yield stress and the shear breakdown. Thus, the flow rate, $\frac{V}{t}$, is is given by

$$\frac{V}{t} = ABC \qquad (1)$$

The term A is the flow rate calculated for a Newtonian oil of viscosity η_0. B is an Einstein-type viscosity correction term for particles in concentrated suspensions and this term is necessary to set an upper limit on the flow at high shear rates. The form of B is assumed to be that proposed by Guth and Simha[7] and is plotted as a function of the volume fraction thickener, V in Figure 1. The term C in Equation 1 was found to depend upon the grease and the pressure, as illustrated for five greases in Figure 2. It was found that these curves could be reduced to a universal curve for all greases studied. This was done by plotting C as a function of the "relative pressure," $\frac{P}{Py}$, where P is the applied pressure, and Py is the "yield pressure"

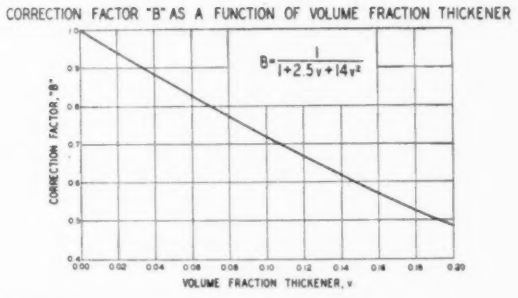

CORRECTION FACTOR "B" AS A FUNCTION OF VOLUME FRACTION THICKENER
B=1/(1+2.5v+14v²)
CORRECTION FACTOR, "B"
VOLUME FRACTION THICKENER, v

FIGURE 1

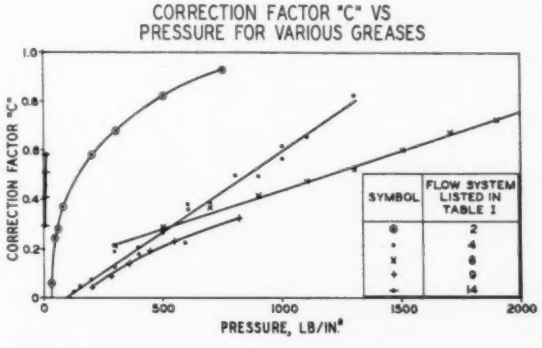


FIGURE 2

(Figure 3). The yield pressure is, therefore, a characteristic of each grease.

For all greases examined, the flow rate, $\frac{V}{t}$, in cc/second at a pressure, P, in dynes/sq cm, was found to obey the following equation:

$$\frac{V}{t} = \left[\frac{\pi Pr^4}{8L\,\eta_0}\right]\left[\frac{1}{1+2.5v+14v^2}\right]\left[C\right] \qquad (2)$$

where the tube length and radius are L and r, respectively; and η_0 is the base oil viscosity. The term C is a function of $\frac{P}{Py}$ for all greases, and this term corrects the flow rate for the relative pressure. Relative pressure in this equation is novel in correlating flow data. Similarly, relative pressure is used to correlate equations of state for gases and also data from adsorption isotherms.

The relationship between C and $\frac{P}{Py}$ as presented here is empirical. For C>0.4, we find that a satisfactory analytical expression for C is

$$C = \left[\frac{P-2Py}{P}\right]^4 \qquad (3)$$

We chose Py such that Equation 3 was satisfied and because the yield pressure so defined agrees reasonably well with yield values observed in capillary viscometry. If it proves desirable to increase or decrease all Py values by a common factor, this can be done by modifying the C curve in Figure 3. The values of Py reported in this paper should be regarded as parameters which have proved useful and convenient.

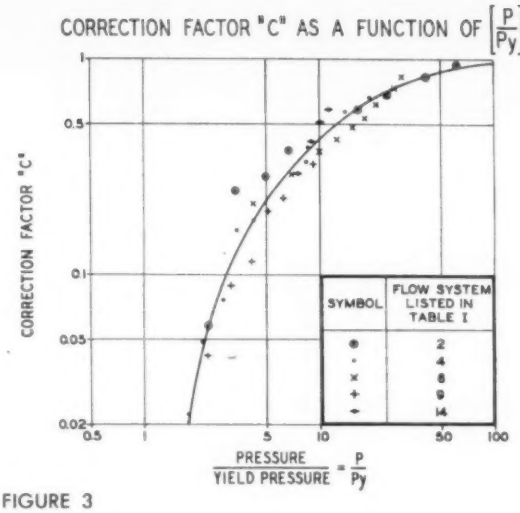


FIGURE 3

Summary of Calculation Procedures

The flow rate of a grease in a tube is calculated as follows when the yield pressure is Py:

1. Calculate A, the flow rate of a Newtonian fluid of viscosity η_0.
2. Determine B from volume fraction thickener (Figure 1).

TABLE I
Grease Data

Flow System Number	Thickener Type	Thickener Weight Per Cent	Oil Type	Oil Viscosity, Poises at 77°F	Reference to Flow Data, Figure	Yield Pressure, Lb./Sq. In. Calculated	Yield Pressure, Lb./Sq. In. Observed in Viscometer (ASTM D 1092-51)	ASTM Penetration Unworked	ASTM Penetration Worked
1	Sodium GA-10*	4	Mineral	2.30	5-A	4	7	370	...
2	Sodium GA-10*	7	Mineral	2.30	5-A	12	25	265	300
3	Sodium GA-10*	13	Mineral	2.30	5-A	50	78	174	222
4	Sodium GA-10*	15	Mineral	2.30	5-A	70	110	155	204
5	Sodium GA-10*	15	Mineral	2.30	5-B	100	80	155	204
6	Sodium GA-10*	13	Mineral	2.30	5-C	70	200	174	222
7	Bentone	6	Mineral	2.30	6-A	6	...	340	...
8	Bentone	12	Mineral	2.30	6-A	50	...	158	172
9	Silica	10	Polybutene	198	6-B	88	...	153	183
10	Lithium Stearate	14	Polybutene	1.39	7-A	12	...	243	291
11	Lithium Stearate	14	Polybutene	18.9	7-B	14	...	297	331
12	Lithium Stearate	14	Polybutene	43.5	7-B	15	...	319	304
13	Lithium Stearate	14	Polybutene	198	7-C	32	...	376	372
14	Lithium Stearate	16	Diester	0.17	7-D	0.55	...	...	...
15	Calcium Soap	7	Mineral	2.74	8-A	0.95	...	...	...
16	Calcium Soap	7	Mineral	2.74	8-B	0.65	...	...	...

*Sodium Salt of Oronite GA-10

3. Determine C from Figure 3 at $\frac{P}{Py}$.

4. Grease flow rate is equal to the product [A] [B] [C].

The yield pressure, Py is readily calculated from flow data for a grease by the following procedure:

1. Measure the flow rate through a calibrated capillary at one pressure, P.
2. Calculate C by substituting the flow data in Equation 2.
3. Determine $\frac{P}{Py}$ from C using Figure 3.
4. Calculate Py from value of C and measured pressure.

$$Py = \frac{P}{(P/Py)}$$

An alternate, less accurate, method to obtain values of Py is to observe the pressure at which flow first becomes visible in a pressure viscometer (ASTM D 1092-55). Yield values thus obtained agree reasonably well with calculated Py values, as shown in Table I.

A second method of obtaining approximate values of Py is to use penetration data and a correlation between Py and penetration values. We find that both worked and unworked penetration values correlate with yield shear stress (Figure 4), but this correlation is not good enough to accurately predict flow rates from penetration data.

Utility of New Equation

The new equation relates flow to pressure for a wide variety of greases and capillaries. This is shown by the close agreement of calculated and observed flow rates of sixteen greases flow systems (Figures 5, 6, 7, and 8). The thickener content for each grease is shown as a per cent figure by each curve. For each grease in a given capillary, only one parameter, the yield pressure, is required for the calculation. The properties of the test greases are listed in Table 1.

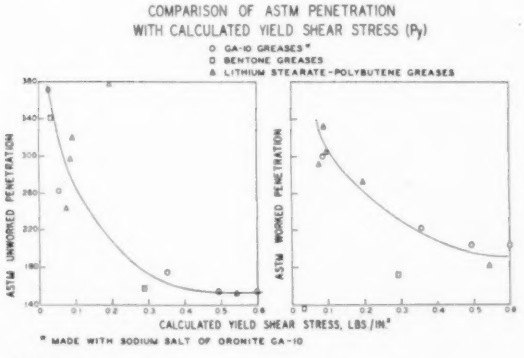

COMPARISON OF ASTM PENETRATION
WITH CALCULATED YIELD SHEAR STRESS (Py)
○ GA-10 GREASES*
□ BENTONE GREASES
△ LITHIUM STEARATE-POLYBUTENE GREASES
ASTM UNWORKED PENETRATION
ASTM WORKED PENETRATION
CALCULATED YIELD SHEAR STRESS, LBS./IN.²
* MADE WITH SODIUM SALT OF ORONITE GA-10

FIGURE 4

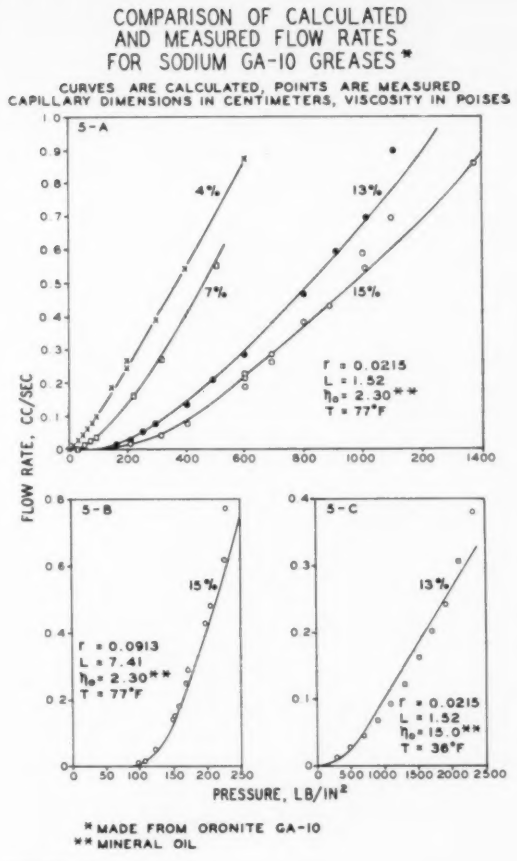


FIGURE 5

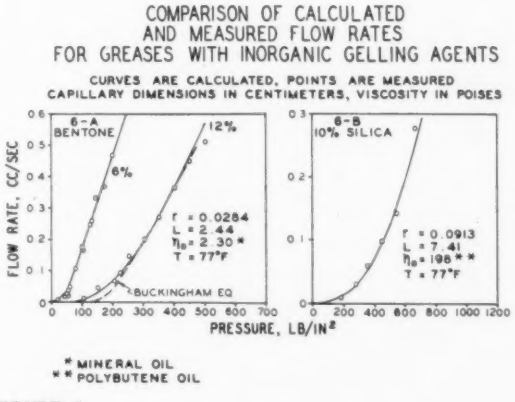


FIGURE 6

The equation was tested on flow data from the literature, as well as on data from this laboratory. The data is Figure 7-D are from work by Singleterry and Stone,[8] and data from Figures 8-A and 8-B are from Blott and Samuel.[9]

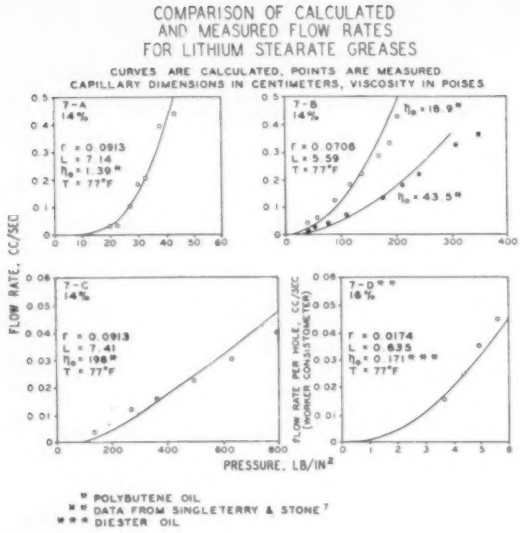


FIGURE 7

The versatility of the equation in calculating flow was tested for the following wide range of variables:

1. Changes in thickener concentration (4-15 per cent) using the same base oil (Figure 5-A and 6-A).
2. Change in type thickener [sodium salt of Oronite GA-10,* Bentone] using the same base oil (Figure 5-A compared to 6-A; Figure 6-B compared to 7-C).
3. Changes in oil viscosity (1.39-198 poises) with the same amount and type of thickener (Figures 7-A, 7-B, and 7-C).
4. Changes in temperature (36°F to 77°F) (Figures 5-C and 5-A).
5. Changes in capillary sizes from [L=1.52cm, r=0.0215cm] to [L=20.4cm, r=0.437cm] (Figures 5-A and 8-B).
6. Changes in the capillary length-to-diameter ratio of 18 to 43 (Figures 7-D and 6-A).
7. Changes in flow rate with pressure where the pressure range varies from 0-1.60 psi to 0-2300 psi (Figures 8-B and 5-C).

The agreement between calculated and observed flow rates is good considering the tremendous range of conditions and materials.

The new equation is useful to predict the effect of temperature on grease viscosity. A temperature increase would decrease the oil viscosity and may change the yield pressure. Temperature changes below the pour point of the oil will also involve a change in the volume fraction thickener due to wax. Exploratory

*As used in Chevron Industrial Grease.

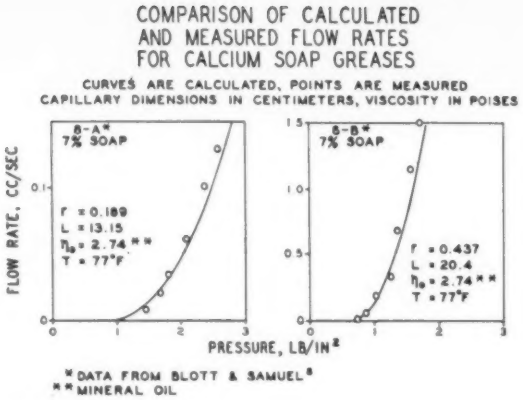


FIGURE 8

work shows that for some greases the change in the flow rate of a grease with temperature is accounted for mainly by the change in oil viscosity.

Comparison of New Equation with Alternate Equations from Literature

Our new equation has distinct advantages over alternate equations in the literature. The Buckingham equation,[3] based in part on findings of Bingham and Green[4] and the equation of Eyring, et al,[5] are two of the most popular published methods of relating flow to shear stress; these will now be compared with the new equation.

The Buckingham equation assumes a Bingham-type material whose flow is defined in terms of two constants, the yield point and an "apparent viscosity" measured at a high shear rate. Unfortunately, greases are not strictly Bingham-type materials. According to Singleterry and Stone[6], Brunstrum and Leet[10] and Mahncke and Tabor,[6] over a limited range of shear rates satisfactory fit is obtained between calculated and observed values for several greases by using the Buckingham equation with its two constants. However, this equation fails to fit the low shear stress region when a wide range of shear rates is to be fitted. Figure 6-A shows the Buckingham and the new equation applied to the same data. The Buckingham equation does not allow even qualitative calculations of the effect of temperature on apparent viscosity, nor does it show the effect of oil viscosity on grease viscosity. Although the Buckingham equation is useful, it is not so versatile or accurate as the new equation.

The Eyring equation needs at least three constants to characterize flow as a function of shear rate for a grease. Using these constants, Eyring[5] has obtained excellent fit of calculated curves with experimental data on four greases. However, this equation has the following limitations:

The three parameters are not readily interpreted as being physically significant, although they have theo-

TABLE II
Comparison of Flow Equations for Greases

Equation	Parameters: In Equation	Parameters: Physically Significant	Fits Data: Low Shear Rates	Fits Data: High Shear Rates	Equation Useful in Predicting Relation of Grease Flow to: Temperature	Oil Viscosity	Thickener Concentration	Capillary Dimensions
New	1	Yes	Good	Good	Yes	Yes	Yes	Yes
Buckingham	2	Yes	Poor	Good	No	No	No	*
Eyring	3	*	Good	Good	*	No	No	*

*Not known or relationship uncertain.

retical justification in absolute reaction rate theory; and this equation does not predict the effect of base oil viscosity on grease viscosity.

Further developments of the Eyring equation may make it more useful for greases, but at present its principal use is to fit flow curves to experimental data.

The advantages and limitations for the Buckingham, the Eyring, and the new equation are summarized in Table 2. We conclude that the new equation is a significant improvement over published methods of calculating and correlating flow data for greases in capillaries.

Discussion

This work suggests that specifications of the flow properties of greases can be simplified. Normally, the apparent viscosity of a grease is specified at several shear rates in order to define the flow properties of the grease. We have shown that for a given capillary, only the yield stress, Py, needs to be specifiied along with the normal inspections of oil viscosity and per cent thickener, in order to define the flow properties of a grease over a wide rang of shear rates.

Future theoretical studies of structure and deformation are needed to derive the empirical relationship between C and $\frac{P}{Py}$ shown in Figure 2.

Although the new equation has been discussed in this paper only as it applies to grease flow, it may also apply to a variety of non-Newtonian thixotropic systems. Further work is needed to evaluate the general utility of the new equation.

Acknowledgment

The author acknowledges the helpfulness of (1) Mr. J. Cortes, Jr., and Dr. A. L. McClellan in obtaining the experimental data and (2) colleagues of the Grease Research Group for stimulating discussions.

References

1. Zimmer, J. C., and Patberg, J. B., *Inst. Spokesman* 9, No. 4, (1945).
2. Marusov, N., *Inst. Spokesman* 15, No. 5, 8 (1951).
3. Buckingham, E., Am. Soc. Testing Materials, Proc. 21, 1154 (1921).
4. Bingham, E. C., and Green, H., Am. Soc. Testing Materials, Proc. 19, 641(1919).
5. a. Eyring, H., Ree, T., Fava, A., and Higuchi, I., *NLGI Spokesman* 20, No. 3, 10(1956).
   b. Hahn, S. J., Ree, T., and Eyring, H., *NLGI Spokesman* 21, No. 3, 12 (1957).
6. Mahncke, H. E., and Tabor, W., *Lubrication Engineering* 11, 22 (1955).
7. Guth, E., and Simha, R. J., Koll, Zeit, 74, 266 (1936).
8. Singleterry, C. R., and Stone, E. E., J. Coll. Sci. 6, 171 (1951).
9. Blott, J. F. T., and Samuel, D. L., Ind. Eng. Chem. 32, 68
10. Brunstrum, L. G., and Leet, R. H., *NLGI Spokesman* 20, No. 3, 24 (1956).

About the Author

D. W. Criddle *graduated from Utah university in* 1947 *and served in the Navy during World War II in the field of applied electronics. He attended the University of California for graduate studies in physical chemistry and received his PhD in* 1950. *His thesis work and subsequent employment with California Research Corp. have been in surface chemistry. His publications on gaseous adsorption, hydrocarbon chromatography, the physical properties of aqueous detergents, and the surface properties of lubricating oil additives indicate a wide and active interest in the field of surface chemistry. Recently he has been engaged in the study of fundamentals of greases.*

Patents and Developments

Thixotropic Lubricating Jelly

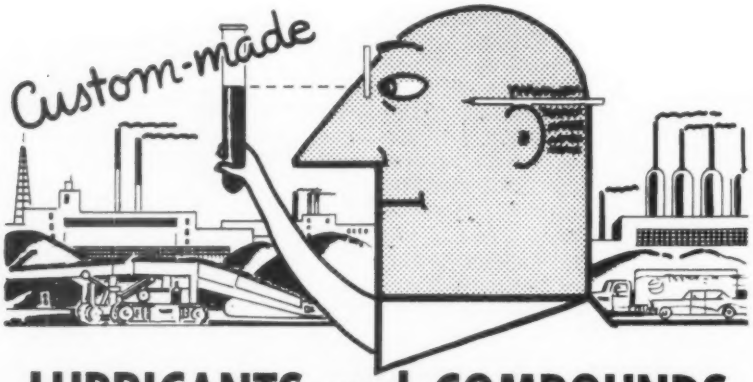
Patent 2,836,562 issued to H. A. Ambrose and P. R. McCarthy, assigned to Gulf Research and Development company. When a mixture of tricresyl phosphate and tributyl phosphite is incorporated in thixotropic mixtures of wax, aluminum soap and oil of at least 145 SUS at 100° F., compositions result which, while retaining their thixotropic properties, have considerably higher dropping points, improved wear properties, lower coefficients of friction and lower oil separation characteristics. Such preferred compositions contain 4-48 weight per cent of a wax of melting point above about 120° F., an aluminum soap in an amount such that the ratio of the soap to wax by weight is about 1:1 to 1:15, and about 0.1-1 per cent by weight of a mixture of tricresyl phosphate and tributyl phosphate in weight ratio of 1:1 to 8:1.

High Temperature Complex Grease Manufacturing Process

Patent No. 2,844,536 issued to A. J. Morway and assigned to Esso Research and Engineering company. Complex lubricating greases are produced wherein the soap system consists of a combination of the salt of a low molecular weight acid and the soap of a high molecular weight acid in the mol ratio of above 2.1:1. The improved process involves the steps of preforming a salt-soap complex lubricating grease containing a salt-soap ratio of 10:1 to 50:1, adding a calculated amount of this complex grease to a simple grease composition, heating the mixture to a temperature substantially below that necessary to complex the salt and soap (below about 350° F), and homogenizing the mixture to obtain a finished grease composition containing one to fifteen mols of salt per mol of soap. Calcium is the preferred base.

Process for Sodium Soap-Salt Thickened Lubricating Greases Containing Sodium Phosphate

Patent No. 2,846,391 issued to A. J. Morway and assigned to Esso Research and Engineering company. Lubricating greases stable at high temperatures and under operating conditions where high rates of shear are involved, are prepared by incorporating therein salts of oxygen acids of phosphorus, especially tri-sodium phosphate, as stabilizing ingredients, either as an element of a complex soap-salt system or in such a manner that no detectable crystals of the salt are found. A grease-forming mixture of rapeseed oil, NaOH and lubricating oil is heated after saponification and dehydration to 475°-575° F to cause the glycerine released by saponification and decomposition products of the glycerine to react with the NaOH, which is maintained in excess above the amount required. Then, there is slowly added to the reaction mixture at above 450° F, before appreciable cooling of the grease, 0.5 to 3.0 weight per cent of orthophosphoric acid which reacts with the excess alkali to produce trisodium phosphate in a form such that no detectable crystals of the salt result.



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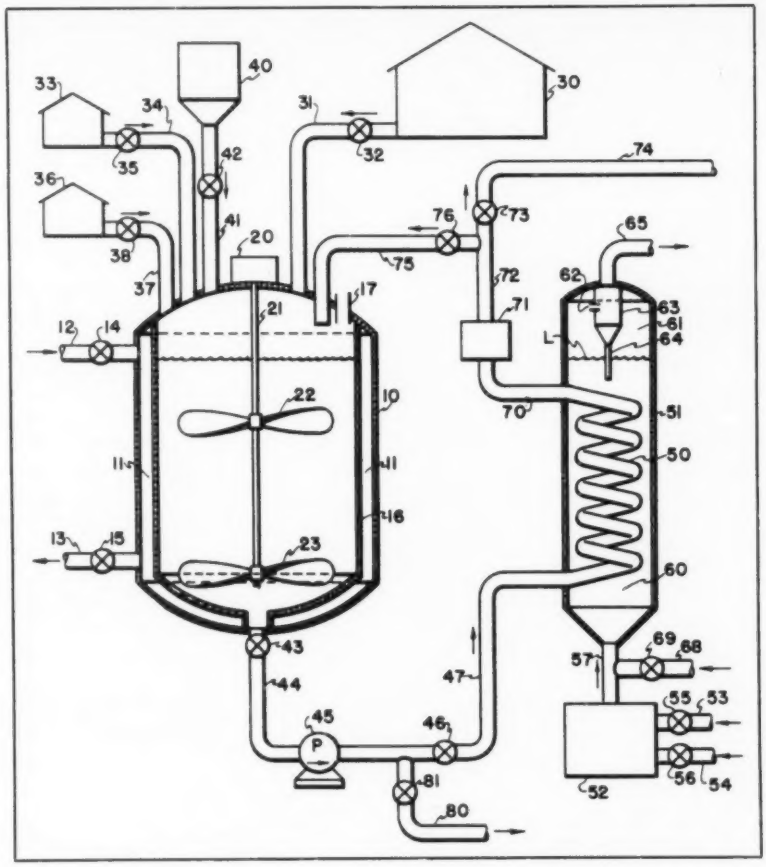

High Salt Content Complex Greases

Patent No. 2,842,495 issued to A. J. Morway and H. G. Vesterdal, assigned to Ecco Research and Engineering company. Entirely new properties are claimed to be built into soap-salt complex greases by incorporating a high molar ratio of salt to soap. Ratios of 8-25 moles of low molecular weight carboxylic acid salts to one mole of high molecular weight carboxylic acid soaps are claimed to give outstanding load-carrying, dispersant, and various other beneficial characteristics in addition to thickening properties comparable to soap-salt complexes containing much lower ratios. Lubrication life of these greases may be increased by subjecting at least 10-20 per cent of the contents of the grease-making zone to a temperature in the range of 700°-1100°F., resulting in a greater hardness for a given soap content. As shown in the drawing, lubricating oil for the grease is run from tank 30 to kettle 10, while low molecular weight carboxylic acids are introduced into the kettle from tank 33, and high molecular weight acids from tank 36. The basic reactant (oxide, hydroxide, etc.) is introduced into the kettle from tank 40. The temperature of inner wall sixteen of kettle ten is adjusted so as not to exceed 600°F., preferably to be at about 500°F., at which point a conventional high salt content complex grease is formed. According to the new improvement, a portion of the grease mixture is pumped by pump 45 through coil 50 heated by combustion gases in space 60 passing through a bed of dense fluidized solid, such as finely divided silica-alumina (L), maintaining a surface temperature of 800°-1000°F. on the inside of coil 50, after which the grease is passed through cooler 71 and back into kettle 10 or to storage through line 74.

Rheopectic Grease Composition

Patent No. 2,846,394 issued to L. C. Brunstrum and H. J. Liehe, and assigned to Standard Oil company (Indiana). A lithium hydroxystearate grease is made which is unique in being fluid as produced but having the property of setting up to grease consistency when exposed to high shear rates such as those encountered in dispensing systems or in gear cases. This rheopectic lubricant consists of an oleaginous base thickened with 1-3½ per cent by weight of the soap having an average particle size of 0.1 to 0.7 micron in length and, a length to width ratio of about 10-50 to 1. Usually, the bulk of the soap particles lie in the range of about 0.4 to 0.5 micron length. The process also provides a "work-up" grease composition

Continued on page 388

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which involves forming a lithium hydroxystearate soap in oil, heating the resulting mixture to a temperature above the melting point of the soap (385°-425° F) and adjusting the soap concentration in oil to 5-15 per cent by weight. The resulting composition then is chilled to about 100°-150° F. and is homogenized. The latter step is important in dispersing the soap uniformly and in obtaining smooth texture, but it does not appear to affect particle size. A gel-like phase results from the rapid cooling from the melt state and homogenizing, which upon heating to 150°-250° F can be diluted with oil to a soap concentration of about 1-3½ per cent to obtain a smooth fluid or semi-fluid composition.

Lithium Base Grease

Patent No. 2,842,493 issued to R. A. Butcosk and assigned to Socony Mobil Oil company. A grease possessing outstanding mechanical stability when worked in presence of excess water and having a wide range of operating conditions is claimed to be obtained with mixtures of lithium soaps in which the acid components comprise balanced proportions of wool grease fatty acids and the aliphatic acids having at least about twelve carbon atoms per molecule, and which contain also relatively small amounts of calcium, strontium, barium and/or zinc soaps of these acids. The acid components of these soaps comprise 15-80 per cent by weight of wool grease fatty acids and the balance comprise aliphatic acids having at least about twelve carbon atoms per molecule. Besides lithium, there must be at least one other metal component (already indicated), with the ratio of lithium to calcium being 27:1 to 6:1, to strontium 42:1 to 2.8:1, to barium 33:1 to 3:1, and to zinc 30:1 to 5:1. The total quantity of these soaps is balanced to provide the grease of the desired character. Preferably, they comprise 7-20 per cent of the finished grease.

In patent 2,842,494 issued to the same parties, a ratio of lithium to the other metals is specified as: sodium 15:1 to 3:1, potassium 50:1 to 10:1, and tin 50:1 to 8:1.

Grease Thickened with Sodium Myristate and a Phthalocyanine

Patent No. 2,836,563 issued to J. P. Dilworth and J. R. Roach, assigned to The Texas company. Phthalocyanine compounds used in conjunction with sodium myristate for thickening greases were found to impart very superior lubricating properties, particularly at elevated temperatures. The composition may contain 5-20 per cent by weight of sodium myristate and 5-20 per cent of phthalocyanine in finely divided form, the particles

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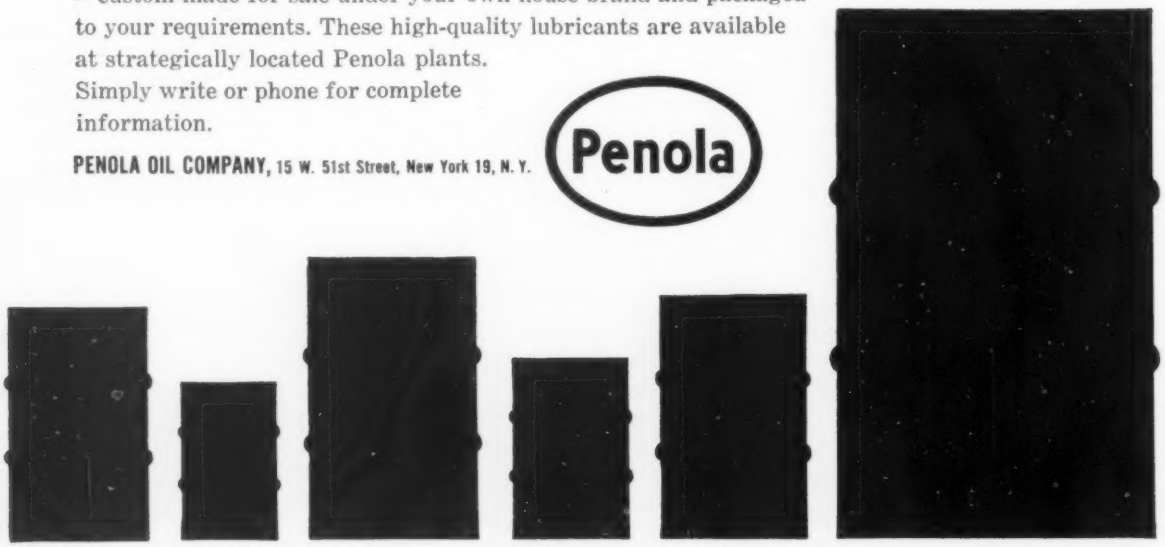
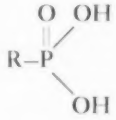


being not over 15 microns diameter, the two compounds being employed preferably in a proportion of 2:1 to 1:2 by weight. Particular advantages are obtained by employing, as the lubricating medium, polyesters obtained by reacting a mono- or poly-alkylene glycol with dicarboxylic acid and a monohydric alcol, such as that obtained by reacting sebacic acid, 2-ethylhexane-1, 3-diol and 2-ethyl-hexanol in about a 2:1:2 ratio. The composition also preferably contains about 0.1-8 per cent by weight of N, N'-diphenyl p-phenylene diamine and 0.5-15 per cent of tricresyl phosphate.

Alkyl Metal Phosphonate Thickened Oils

Patent No. 2,837,481 issued to B. W. Hotten and F. O. Johnson, assigned to California Research corporation. Emulsification - resistant multipurpose greases are claimed to be prepared by the use, as thickening agents, of metal salts of phosphonic acids represented by the formula:



wherein "R" represents straight-chain or branched-chain saturated or unsaturated hydrocarbon radicals having from 12 to 40 carbon atoms, the average molecular weight of "R" preferably being 150-300. Examples are lithium, sodium, calcium, or barium dodecane phosphonate, eicosane phosphonate, diesel fuel phosphonate, petroleum wax phosphonate, and the like, in amounts of 7-50 per cent by weight.

Water-and Corrosion-Resistant Greases Gelled with Inorganic Colloids

Patent 2,836,560 issued to R. S. Teale, H. Seeles, and H. R. K. F. R. Konau, assigned to Shell Development company. Aliphatic compounds containing a halogen atom and an epoxy-oxygen atom, such as haloepoxyalkanes, have been found to be effective in improving water and corrosion resistance of lubricating greases containing an inorganic gelling agent, such as silica. Examples include epichlorohydrin, 2, 3-epoxy-4-chlorobutane, 1, 2-epoxy-4-methyl-5-bromopentane, etc., and they are added in amounts of 0.01 to 3 per cent by weight of the grease. Anti-corrosion effect is improved by addition of 0.01 to 3 per cent by weight of the grease, of aliphatic carboxylic acids, such as malonic, succinic, octadecyl succinic, and similar acids.

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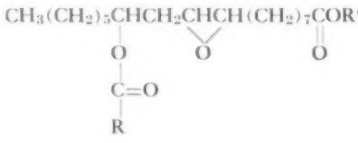
Metal Soap-Salt Complexes in Greases

Patent No. 2,846,392 issued to A. J. Morway and J. J. Kolfenbach, assigned to Esso Research and Engineering company. Complexes of metal salts of low molecular weight carboxylic acids with metal soaps of high molecular weight carboxylic acids, which contain at least as high as seven moles and up to as much as 40 moles or more (preferably 25) of the low molecular weight acid per mole of high molecular weight acid (as in patent 2,842,495) are claimed to have outstanding load-carrying, dispersant, detergent, and other beneficial characteristics in addition to thickening action. The soap acids preferably contain 12 to 30 carbon atoms per molecule, and the salt is preferably calcium acetate. The complex is prepared by heating the mixture in an organic liquid dispersant (e.g., lubricating oil, silicone oils, diesters, etc.) to 450°-550° F.

Lithium Greases Containing Alkyl Epoxy Acyloxy Stearates

Patent 2,841,557 issued to J. W. Nelson and assigned to Sinclair Refining company. Excellent lithium greases are prepared, using as a fatty acid radical source one or more alkyl epoxy acyloxy stearates having the formula:



where R and R′ are lower alkyl radicals, R preferably containing not more than five carbon atoms, and R′ not more than six carbon atoms. The stearate material is exceptionally difficult to saponify, but this can be satisfactorily accomplished provided that there is included in the reaction mixture about two moles of lithium base (1.75-2.25) per mole of stearate and at least fifteen moles of water (20-100) per mole of lithium base. The reaction mixture is heated to 400° F to form the desired soap and at the same time dehydrate the mixture.

Grease Containing Surface-Esterified Silicious Solid and Organophilic Clay

Patent 2,847,380 issued to J. L. Zakin, assigned to Socony Mobil Oil company. A non-soap grease having unexpected rust preventive properties is prepared by compounding a substantial amount of two inorganic grease thickening agents, an organophilic clay (bentonite) and an organophilic esterified product (estersil) or amorphous silica having a specific surface area of 25-900 square meters per gram coated with alkoxy groups containing two to eighteen carbon atoms, in a ratio of 3:1 to 1:3 bentonite to estersil. The bentonite has its exchangeable inorganic cation replaced by an organic ammonium base having a carbon chain of at least 10 carbon

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Saponification Value	180.	188.	180.
Hydroxyl Value	160.	154.	171.
Heat Stability Loss of Acid Value (6 hrs. at 285°F)	NONE	24%	NONE
Loss of Hydroxyl Value (6 hrs. at 285°F)	NEGLIGIBLE	27%	NEGLIGIBLE

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atoms, e.g., those sold commercially under the designation "Bentones." The estersils are prepared by esterification of the siliceous solid with a primary or secondary alcohol containing 2-18 carbon atoms, such as "Estersil GT" marketed by Du Pont. Up to one per cent of pentaerythritol may be added to the composition as a high temperature stability agent. Anti-wear agents also may be added, such as urethanes, carbazides, carbazones, etc.

Metal N-Acyl Sarcosinate Thicked Lubricating Oils

Patent No. 2,841,555 issued to J. F. Lyons and P. R. Thomas, assigned to The Texas company. Greases thickened with 10-40 weight percent of N-acyl sarcosine salt in 60-90 percent oleaginous lubricating base, suitable especially for lubrication of marine machinery, is claimed. Sarcosine is N-methyl glycine, and sarcosines having aliphatic hydrocarbon radicals containing 10-24 carbon atoms, e.g., N-lauroyl sarcosine, N-stearoyl sarcosine, etc., are used for this purpose. Lithium bases are preferred, although calcium and calcium-sodium soaps are described as well.

Anhydrous Calcium-Base Grease

Patent No. 2,847,381 issued to T. W. Martinek, assigned to The Pure Oil company. Anhydrous calcium soap base greases are prepared which not only have very high dropping points enabling use at high temperatures over long periods, but which are obtainable in high yields and have homogeneous structures and increased oxidation stability over wide temperature ranges. Such greases are claimed to not require milling and are preparable from inexpensive and simple ingredients. Such greases contain (1) calcium metal soap of saturated, hydroxy fatty acids having 12-24 carbon atoms in the carbon chain, e.g., 17 hydroxy stearic acid, (2) calcium or other alkaline earth metal salt of saturated, non-hydroxy or hydroxy aliphatic carboxylic acids having 1-8 carbon atoms in the carbon chain, e.g., formic, caproic or succinic acids, (3) calcium soap of saturated, non-hydroxy fatty acids having at least 20 carbon atoms in the fatty acid radical, or the calcium soap of a mono-unsaturated, non-hydroxy fatty acid having at least 18 carbon atoms in the carbon chain; with the further provision that unless the fatty acid radical of soap (3) contains a double bond, carbon atoms in the carbon chain differ by at least two from the number of carbon atoms in the chain of the soap of (1) above; e.g., oleic, vaccenic and erucic acids. The two soap-forming acidic materials (components one and three and the salt-forming acidic material (component two may be used in a range of 0.5 per cent-15 per cent by weight. The soap of the first component of the fatty acid mixture, which is used in the gelation agent, is present in an amount of 25-75 per cent by weight of the total mixed soaps of the gelation agent, and the soap of the third component is present in an amount of 75-25 per cent. The soaps of components one and three, which represent all of the gelation agents, may be present in approximately equal proportions. The greater the difference between the number of carbon atoms of fatty component one from that of three, the better the grease. Where the component three acid is a saturated, non-hydroxy fatty acid of at least 20 carbon atoms, a minimum of two carbon atoms difference is essential. The ratio of the acids of components one and three is generally governed by the difference in the number of carbon atoms between the two. The preferred concentration range for component two of the grease, is approximately in a mol ratio to the combined soaps of components one and three of 1-2:1.

Extreme High Temperature Grease

Patent No. 2,848,417 issued to J. W. Armstrong and H. A. Woods, and assigned to Shell Development company. Grease compositions displaying outstanding stability and excellent lubricating properties at

Continued on page 392

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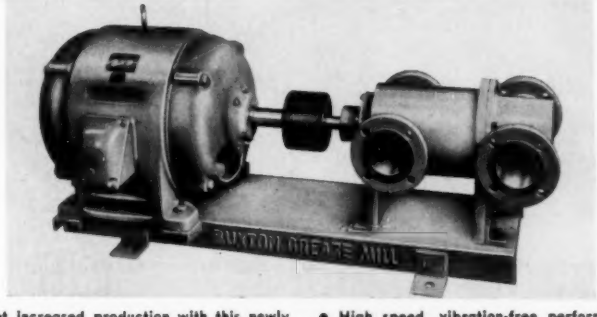

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above 400-450° F are claimed to be prepared by thickening silicone polymer oils with 10-60 per cent by weight of indanthrene compounds having melting points over 250° F, preferably those without neutralization of the carbonyl groups with ions such as sodium, potassium, etc. Typical compounds include indanthrene blue, indanthrene yellow g, indanthrene golden orange, etc. High temperature soap grease compositions, such as those containing beeswax acid soaps containing high temperature improving agents, such as sodium benzoate, may be made more resistant to high temperatures by addition of at least 50 per cent (of the weight of the thickener) of these indanthrene dyes. Silica gel thickeners and similar materials also may be used in conjunction therewith. A paste containing 20.9 per cent indanthrone is commercially available from General Dyestuffs corporation.

Lithium Grease Manufacture

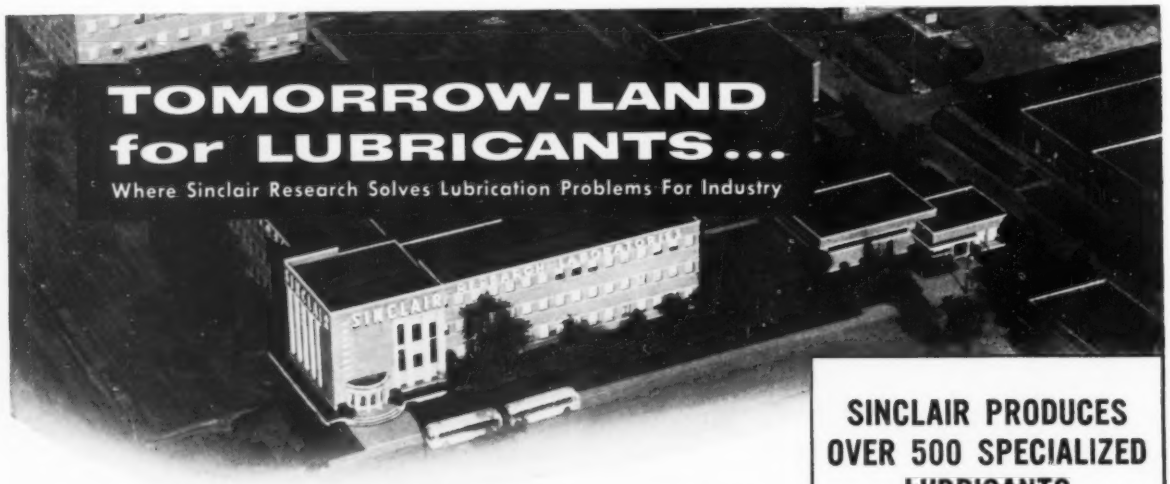
Patent No. 2,847,382 issued to M. E. Erwin, L. U. Franklin and J. C. Gebhart, and assigned to Gulf Oil corporation. Improved smooth texture greases are claimed to be obtained from a lithium soap and an oil by a process involving heating a mixture of fatty material, a lithium compound capable of saponifying therewith, an oil and water (0.7 to 1.0 per cent by weight) in a closed container until an elevated pressure (30-90 psig) is reached (20-45 minutes) venting the vapors formed, and progressively reducing the pressure while continuing heating until the contents of the container are substantially simultaneously at a temperature (390°-400° F) high enough to melt the soap and about atmospheric pressure, and thereafter adding additional oil to produce the desired grade of grease.

Process for Preparing Anhydrous Lime Grease

Patent No. 2,841,556 issued to R. A. Swenson and S. J. Sajac, assigned to Standard Oil company (Indiana). Stable, substantially anhydrous calcium hydroxy stearate greases are claimed to be rapidly prepared by saponifying the fatty acid with lime, preferably in presence of the oleaginous vehicle, and effecting the desired grease structure by the addition of water at 220° F or higher and subsequently dehydrating the grease base at 250°-300° F. About 0.1 per cent-10 per cent of water is first added, and 0.1 per cent-5 per cent additional water is added to the heavy soap after the heating to 250°-300°F.

Homogeneous Lithium Base Lubricating Grease Compositions

Patent No. 2,844,537 issued to P. R. McCarthy and T. R. Orem, assigned to Gulf Research and Development company. Stable lithium base greases requiring no milling or homogenization to produce a finished product, are prepared from a suitable lubricating oil thickened to a grease with a lithium soap of a mixture of saturated, unsubstituted fatty acids having at least twelve



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carbon atoms (the mixture containing acids having at least 20 carbon atoms and those having less than 20 atoms), to obtain a finished grease and without requiring use of special additives. By properly proportioning the mixture of the fatty acids used in the ratio of those having at least 20 carbon atoms to those having less than 20 carbon atoms of from 1:10 to 1:1, an excellent finished lithium base grease is claimed to be produced without any need of milling or homogenization. Hydrogenated fish oil fatty acids are the preferred source of acids having at least 20 carbon atoms, although hydrogenated rapeseed oil fatty acids and Fischer-Tropsch acids also may be used.

Polyethylene Phosphonates as Grease Thickeners

Patent No. 2,837,480 issued to B. W. Hotten and F. O. Johnson, assigned to California Research corporation. This is similar to 2,837,-481, with the exception that "R" represents a polyethylene radical having a molecular weight of 750-100,000. The phosphonic acids may be prepared as described in patent 2,683,168, wherein polyethylene is reacted with phosphorus trichloride in presence of oxygen, followed by hydrolysis of the phosphonyl dichloride formed.

News Items

The Air Research and Development Command claims that polyphenyl ethers are possible substitutes for lubricating oil, and can stand up under nuclear radiation and wide range of temperatures (*Newark Evening News* 7/28/58 p. 3).

Grease containing moly sulfide additive is being promoted by Standard Oil (Ky.) and Climax Molybdenum as a regular chassis lubricant for passenger cars. According to E. Smith of Climax, performance claims for gasoline do not have the drawing power they used to have, and motorists are coming in less frequently for oil changes (*Business Wk.* 7/2/58, p. 53).

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People in the Industry

Shell Announces Changes In Marketing Staff

Shell Oil company announced three personnel changes in its marketing staff.

B. G. Symon, manager of Shell's industrial products department, has been named general sales manager for International Lubricant corporation, New Orleans.

International Lubricant manufactures and compounds greases and lubricating oils for Shell and the general trade.

Mr. Symon, who has served for several years as director of this corporation, will begin his new duties in New Orleans on or about December 1.

T. F. Shaffer, assistant manager of Shell's industrial products department, replaced Mr. Symon, effective October 1.

J. L. Webster, now sales manager for International Lubricant, will become assistant to the manager of industrial products in Shell's San Francisco office, effective December 1.

A native of Brookfield, Mo., and a mechanical engineering graduate from the University of Missouri, Mr. Symon began his career with Shell in 1923 as assistant to the manager of the lubricants department in St. Louis.

In 1940, he moved to New York as manager of the technical products department, and was named manager of the lubricants department two years later. He was named to his present position in August, 1955. A member of the Board of Directors of NLGI since 1945, Mr. Symon served as the Institute's sixteenth president in 1948-49.

Mr. Shaffer is a graduate of Case Institute of Technology, Cleveland. He joined Shell in 1937 as a salesman in Cleveland. Subsequently, he served as lubricants manager in Cleveland and Los Angeles. In 1951, he moved to head office as manager of the special products department.

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Mr. Shaffer was named to his present position in 1955.

Mr. Webster was born in Lockhart, Texas. He studied at the University of Southern California's extension school at Los Angeles. In 1922, he went to work for Shell Oil company as a clerk in Madera, Calif.

He was transferred to the East coast in 1938, and named division sales manager in Boston in 1940. In 1946, he moved to New Orleans as sales manager of International Lubricant corporation.

Dilworth Granted Patent

J. P. Dilworth, T. B. Jordan, and R. C. Givens, technical employees at the Texas company, are co-patentees of a recently issued patent, U. S. 2,827,395, assigned to The Texas Company and covering improvements in process for coating a gas filter.

Mr. Dilworth is assistant supervisor of the lubricants research department at the Texaco research center at Beacon, New York. He joined the center in June, 1939, after receiving his B. S. degree in industrial chemistry from Kansas State college.

He has held a succession of assignments in the analytical and testing, standardization, and grease research departments at the center, and on many occasions has worked on grease processing problems at Texaco's Port Arthur, Texas works.

Mr. Dilworth is a member of Phi Lambda Upsilon, the American Chemical Society, and the Research Society of America.

He is the author of three technical papers dealing with grease lubrication, and holds fourteen other patents in the field of grease manufacture and compositions.

Technical Service Director Named by Girdler Catalysts

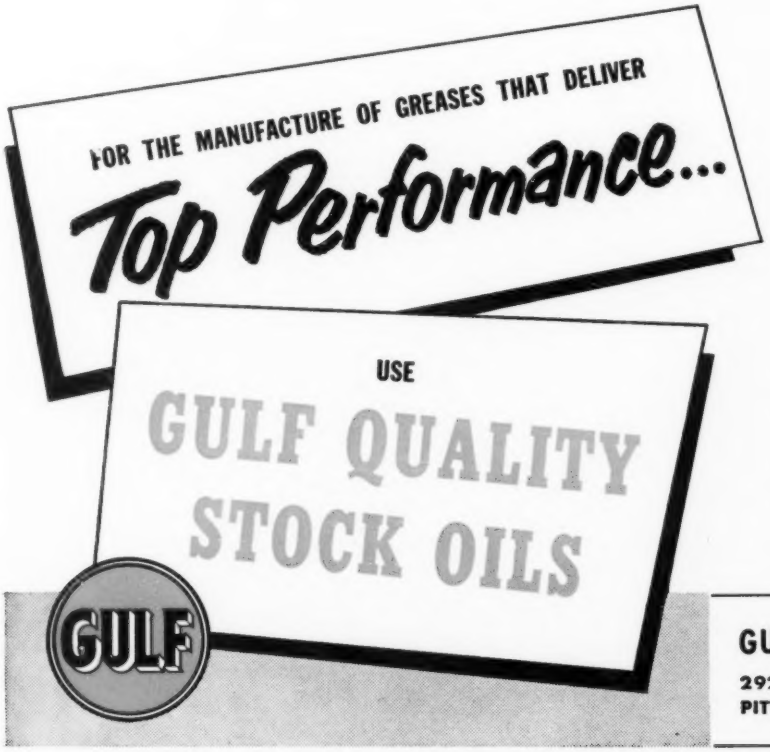
Appointment of Robert Habermehl Jr. as technical service director for Girdler Catalysts is announced by the chemical products division of Chemetron corporation.

Howard D. Hartough, Girdler catalyst manager, said Habermehl will make his headquarters in Louisville and be in charge of the technical service staff which assists customers in the use of Girdler specialty catalysts, advises on the design of plants in the chemical, petroleum, synthesis gas and related fields, and assists in customer's plant start-up.

Habermehl has been in catalyst research and technical service work since joining the company in 1950.

He holds a bachelor of science degree in chemistry from the University of Kentucky and has engaged in advanced studies at the speed scientific graduate school of the University of Louisville. He is a member of the American Chemical Society, The Philadelphia Catalysis club, Alpha Chi Sigma and Sigma Pi Sigma, and is author of

Continued on page 396



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Habermehl is a native of Augusta, Ky. and previously taught science at Augusta High school.

Glover Named Manager

Robert M. Glover, for the last two and a half years assistant sales manager of the Du Pont company's petroleum chemicals division, has been named manager of the newly created sales program section of the division, while Wilfred E. Bettoney has been designated additive sales manager.

In other changes, all of which became effective October 1, Richard O. Braendle took over Mr. Bettoney's duties as technical manager in the Eastern region office, New York City, and Charles B. Miller assumed Mr. Braendle's position as technical manager in the Mid-Continent region office at Tulsa.

Joseph J. Mikita, who since February, 1956, has been both additive sales manager and technical manager for the division, will devote full time to management of the technical section, including direction of the division's petroleum laboratory located at Deepwater Point, N. J.

The new sales program section of the petroleum chemicals division will be responsible for sales promotion programs, conventions, advertising, and petroleum marketing activities, according to W. A. Taft, director of sales.

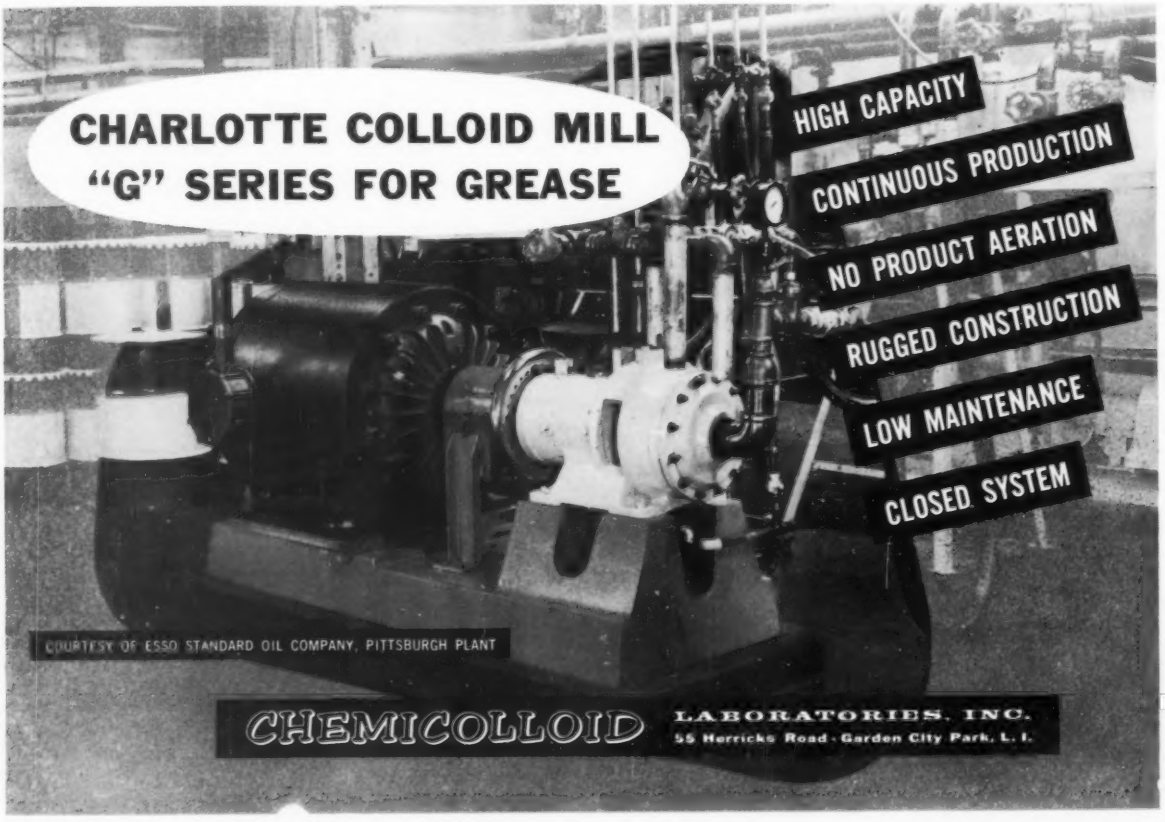
Strom, Lubrication Engineer, Wins Promotion at Dixon

Edwin M. Strom, for the past two years assistant manager of the graphite and lubricants division of the Joseph Dixon Crucible company, Jersey City, N. J., has been promoted to manager of the division, it has been announced by H. E. Ehlers, Jr., vice-president in charge of sales.

Mr. Strom will continue to give primary attention to the further development and field testing of Dixon natural colloidal graphite, a new product developed for the first time in the United States by Dixon. Deeply involved in the initial developmental stages, Mr. Strom currently plans to achieve wider acceptance of the product in the national market.

He joined the Dixon organization eight years ago, starting in the sales department of the division he now heads. Between 1952 and 1956, he was field representative in the Philadelphia-Baltimore territory.

Mr. Strom is married and the father of two children. He resides in New Brunswick, N. J. with his family. A member of the New York section of the American Society of Lubrication Engineers, he was recently appointed to the post of program chairman of the organization.



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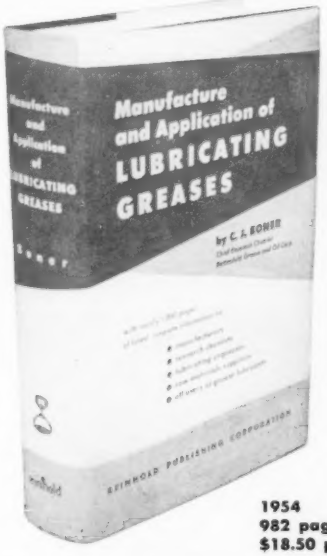

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Of major interest is the large section on present uses and future trends of lubricating grease products. Here you'll find the complete details of when, where, and how to apply a specific lubricant for any given purpose.

Everyone concerned with the preparation or use of grease lubricants will find Boner's book of enormous practical value. Manufacturers and lubricating engineers will find here a complete breakdown of the effects of each ingredient or treatment upon the characteristics of the final product, and a full explanation of the physical and chemical methods used in measuring these characteristics. Suppliers of fats, oils, additives, thickeners and other raw materials will gain new ideas for future product research and development. In addition, users of grease products will learn the properties of available lubricants and the major purposes that each fulfills.

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Industry News

Pure Oil Co. Announces New Chassis Dynamometer

The Pure Oil company has unveiled its new chassis dynamometer, or automobile treadmill, for indoor road testing of fuels and lubricants. The installation occupies a seven-room wing at Pure's research center.

A car can be driven up to 120 miles an hour in the dynamometer test room while standing still. Its front wheels are clamped to the floor and its rear wheels rest upon and drive two large steel drums that extend below the floor into the basement.

"The dynamometer can duplicate a range of outdoor driving conditions," Hugh L. Hemmingway, Pure's director of research, said. "It can be set for uphill, downhill, or level driving. It can create cooling winds up to 80 miles an hour. The air temperature can be varied from 70 to 100 degree Farenheit.

"The dynamometer's air-conditioning system permits us to standardize the weather and to test gasoline, lubricants, and other products under exactly the same conditions," Mr. Hemmingway said. "This makes for highly accurate test comparisons. Outdoor weather variations and changing traffic conditions often make successive experiments difficult to compare and evaluate.

"Another advantage of the dynamometer is that cars can be driven at high speeds in perfect safety over prolonged periods."

Pure's chassis dynamometer, the third in the Chicago area, will accommodate any car in the center's Rambler-to-Cadillac test fleet and can even handle small and medium trucks. The installation was designed by Pure Oil engineers and scientists.

In most cases a driver will remain in a car while it is being tested, but tests can be conducted with driverless cars.

The dynamometer's mission is to allow gasolines and lubricants to be tested under highway driving conditions. Recording instruments are installed in or alongside the car in the test room.

Studies on the schedule include the volatility characteristics of fuels, additive performance, exhaust gas composition, and abnormal combustion such as surface ignition. In gear lubricant tests, the dynamometer may be set to simulate high speed long distance driving or operation in a mountainous region.

Certain products, such as tires, chassis lubricants, and some gear oils, cannot be tested on the dynamometer, and the company is continuing to make outdoor road tests.

The heart of the test equipment, which is located in a basement under the test room, looks like a giant electric motor. Its purpose is to absorb and measure the power of the automobile. When electric current is fed into the unit, it acts as a motor and allows the car to "coast downhill."

To duplicate the varying conditions of resistance encountered by moving autos, the dynamometer unit is supplemented by an inertia loader and an air resistance fan. In an uphill climb, the dynamometer unit provides the extra resistance that the car must overcome. The inertia loader is adjusted to represent the weight, or inertia, of the individual test car during acceleration, and the air resistance fan absorbs the power required for the car to overcome air resistance.

An elaborate air - conditioning system controls the temperature and humidity, filters the air and supplies conditioned air to replace that removed in the exhaust. A centrifugal fan can circulate 55,000 cubic feet of air per minute at a velocity of 80 miles an hour, simulating the cooling effect of outdoor air on a moving car. A unique feature of Pure's fan is that its speed can be adjusted to lead or lag the auto's speed when special underhood temperatures are desired. The fan speed can also be maintained proportional to the test car's speed by automatic controls.

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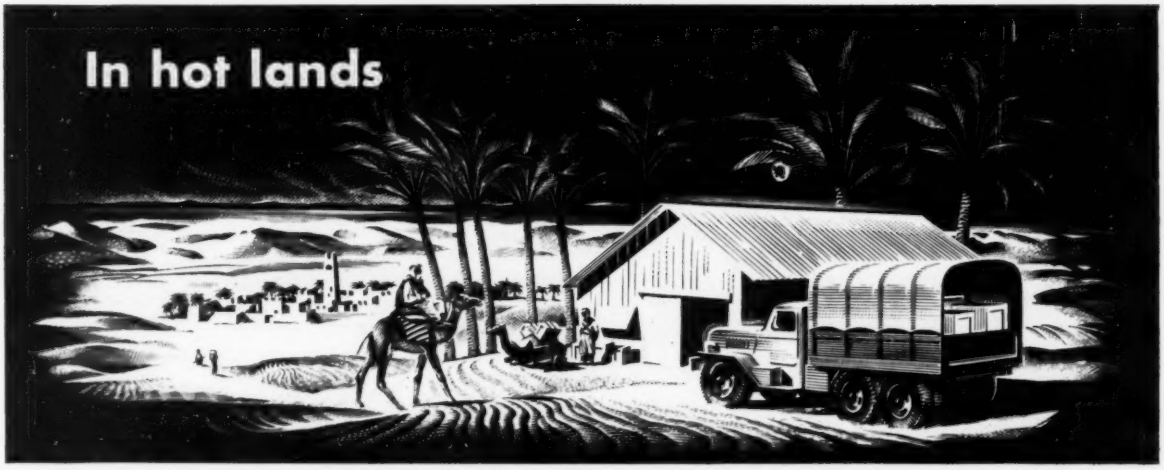

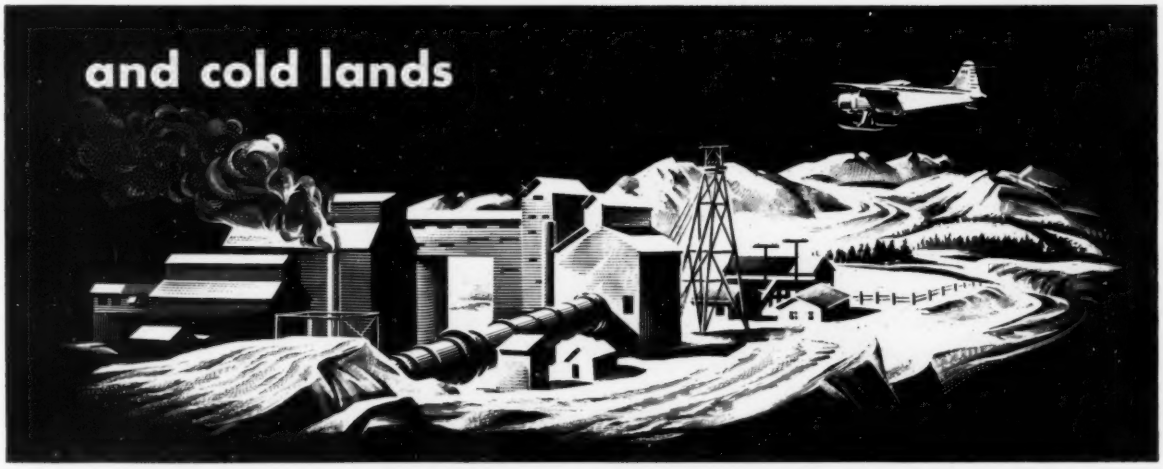

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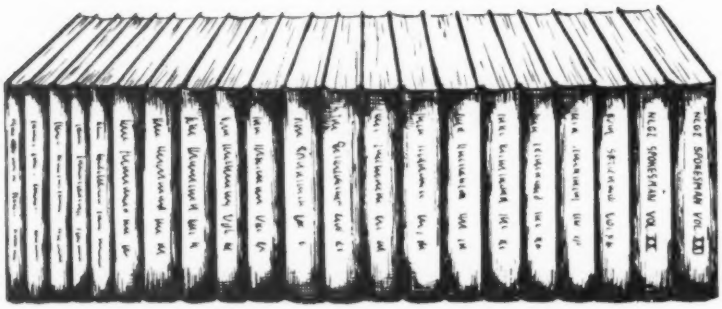

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Ten Specifications Published As American Standards

Two recent events mark further progress in the development of uniform national standards for metal containers, such as are used widely in the chemical, petroleum, and related industries.

Ten specifications for metal drums and pails ranging from 5 to 55 gallons have just been published as American Standards.

A standards committee newly formed this year under the procedures of the American Standards association, and sponsored by the Steel Shipping Container Institute, held its first meeting on September 17 to discuss further national standards work for metal containers and to deal with revisions proposed for the existing standards.

This is the history of the project: In 1950, the Steel Shipping Container Institute began to cooperate with the Petroleum Packaging committee, the Manufacturing Chemists' association, and other industry groups, as well as military and civilian government agencies in the development of standards of dimensions and construction for ten types of steel drums and pails.

In 1954, recommendations of these industries for drum and pail standards were published by the Steel Container Institute under the title, "Recommended Universal Standards for Steel Drums and Pails," and by the Packaging Institute as "Petroleum Packaging Committee Report No. 2."

In 1957, the ten specifications for steel drums and pails were submitted to the American Standards association (ASA) for approvals as American Standards. ASA canvassed all organizations that were expected to have a substantial interest in the specifications in order to determine whether the proposals were supported by a national consensus.

In March, 1958, ASA called a general conference to discuss comments received as a result of the canvass and to make arrangements for future revisions of the standards. The most important outcome of the conference was the formation of a new sectional committee (standards committee) to deal with national standards for metal drums and pails.

The first meeting of the new sectional committee on September 17 was attended by representatives of the Steel Shipping Container Institute, the Petroleum Packaging committee of the Packaging Institute, the Manufacturing Chemists' association, and staff members of the American Standards association. The National Paint, Varnish, and Lacquer association assured the

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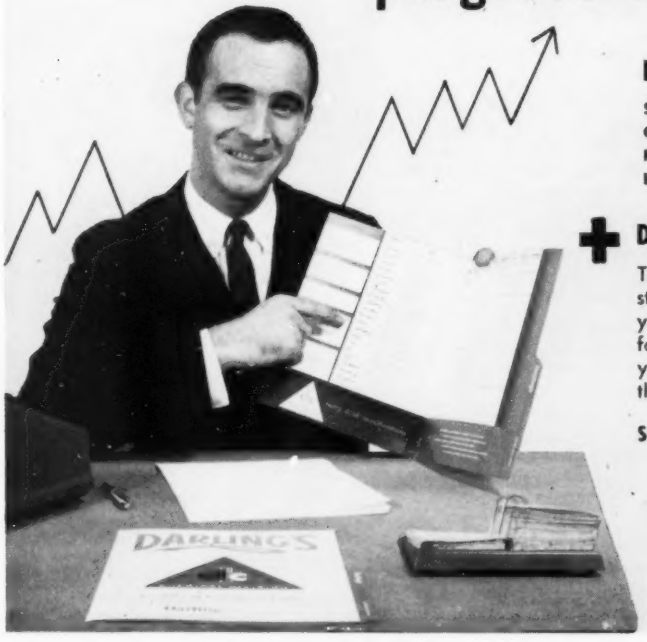

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meeting by letter of its interest and future cooperation.

The meeting set up a task force consisting of two representatives of each association. The task force will be concerned with the technical aspects of the development, review, and revisions of the standards. It will also explore new areas of standardization in the drum field.

The ten specifications, approved as American Standards, and now published are:

MH2.1-1958—American Standard Specifications for 55-Gallon Tight Head Universal Drum (ICC-17E).

MH2.2-1958—American Standard Specifications for 55-Gallon Full Open Head Universal Drum.

MH2.3-1958—American Standard Specifications for 55-Gallon Tight Head Universal Drum (ICC-5B).

MH2.4-1958—American Standard Specifications for 55-Gallon Tight Head Universal Drum (ICC-17C).

MH2.5-1958—American Standard Specifications for 55-Gallon Full Open Head Universal Drum (ICC-17H).

MH2.6-1958—American Standard Specifications for 30-Gallon Tight Head Universal Drum (ICC-17E).

MH2.7-1958—American Standard Specifications for 16-Gallon Tight Head Universal Drum.

MH2.8-1958—American Standard Specifications for 16-Gallon Full Open Head Lug Cover Universal Drum.

MH2.9-1958—American Standard Specifications for 5-Gallon Tight Head Universal Drum (ICC-17E).

MH2.10-1958 — American Standard Specifications for 5-Gallon Lug Cover Universal Pail (ICC-37A).

The complete set of ten standards is available at $1.00 per set from American Standards association, Dept. PR22, 70 East 45 Street, New York 17, N. Y.

Socony Announces Plans For Patents

Socony Mobil announces plans for a non-exclusive licensing of their recent patents for improved lithium greases. U.S.P. Nos. 2,842,493 and 494, patented July 8, 1958, cover the use of straight lithium and lithium mixed-base greases containing balanced proportions of soaps of wool grease fatty acids and of conventional fatty acids.

These compositions show superior performance, particularly under wet conditions of use where many lithium greases are prone to show excessive breakdown and provide little in the way of rust protection when the grease becomes contaminated with water.

In addition, they are readily compatible with conventional greases and pose no mixture problems. The dropping points of new greases range as high as 400° F and are normally above that of a lithium stearate grease.

Calcium Nitrate, Technical, Offered

Hummel Chemical company, Inc., 90 West street, New York, is now offering a technical grade of calcium nitrate for the manufacture of lubricating oil additives. A technical data sheet and further information are available on request.

Vulcan to Open Plant In Western Canada

A plant to produce steel shipping pails used for the safe packaging and shipment of paints, chemicals, adhesives, oil and similar products will begin production in early November, in Vancouver, British Columbia, Canada. The Vulcan plant is the first steel pail manufacturing facility in Canada's Pacific coast according to a joint announcement by Vern I. McCarthy, president, Vulcan Containers Inc., Bellwood, Illinois and Norman G. Bernecker, president, Vulcan Containers Limited, Toronto, Ontario, Canada.

Vulcan, 42-year-old manufacturer of steel shipping pails and drums, soon celebrating its fifth anniversary in Canada, is now known throughout Canada for its exceptional service from warehouse stocks and wide variety of metal containers. Increasing demand by container users prompted Vulcan, Canada, to better serve the growing western territory by producing containers in Vancouver. "We will tailor our production directly to the requirements of Western Canadian industry" reported McCarthy and Bernecker.

Bernecker stated that production machinery is now being installed in a recently acquired one-story building of 10,000 square feet. In addition to steel pails, tinplate cans for printing ink and other products will also be stocked for prompt shipment at the plant located at 50 Braid street, New Westminster, B. C.

A. W. "Bud" Cooney has been named sales representative and R. Gregory Brady has been appointed plant superintendent. Officers are Norman G. Bernecker, president; Vern I. McCarthy, executive vice president; and V. I. McCarthy, Jr., vice president.

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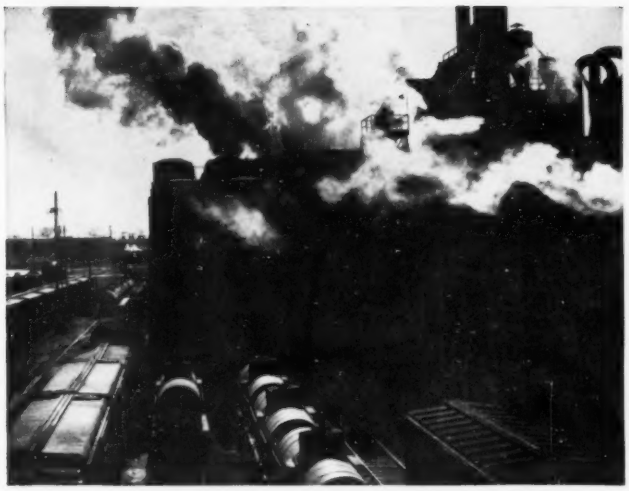

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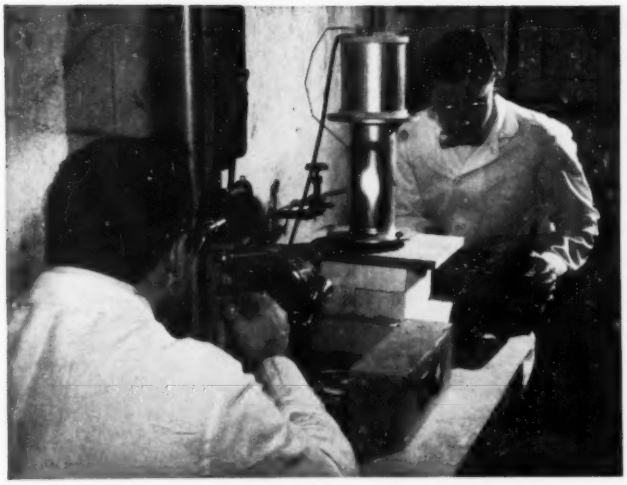

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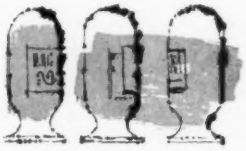

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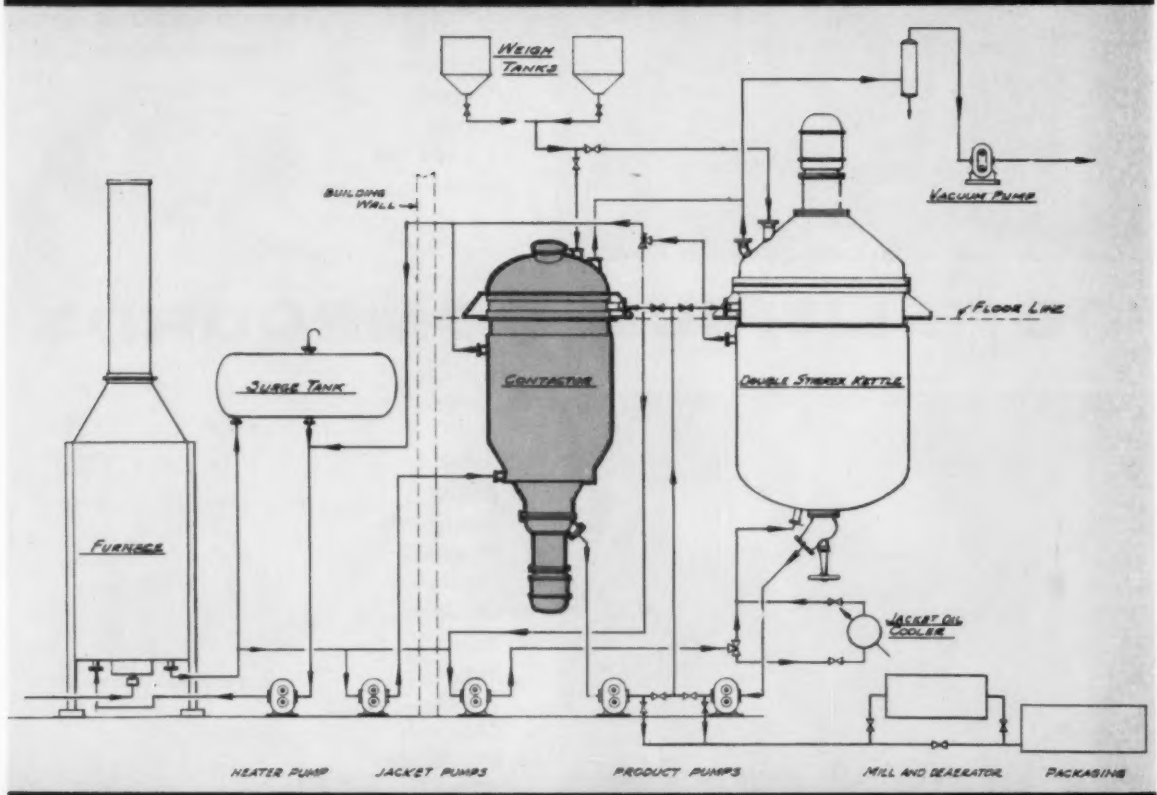

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A complete Stratco plant layout is illustrated above. Equipment is adaptable to modernization programs as well as new installations. Specific equipment recommendations made without obligation.

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